

MAINTENANCE MANUAL

LIST OF EFFECTIVE PAGES

Chapter 24
ELECTRICAL POWER

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Chapter 24

ELECTRICAL POWER - DESCRIPTION AND OPERATION1. General

The ac power generating system supplies sufficient power to operate all ac and dc electrical and electronic systems. See Figure 1 for a perspective diagram of the power supply system.

The major components of the electrical power system consists of the following:

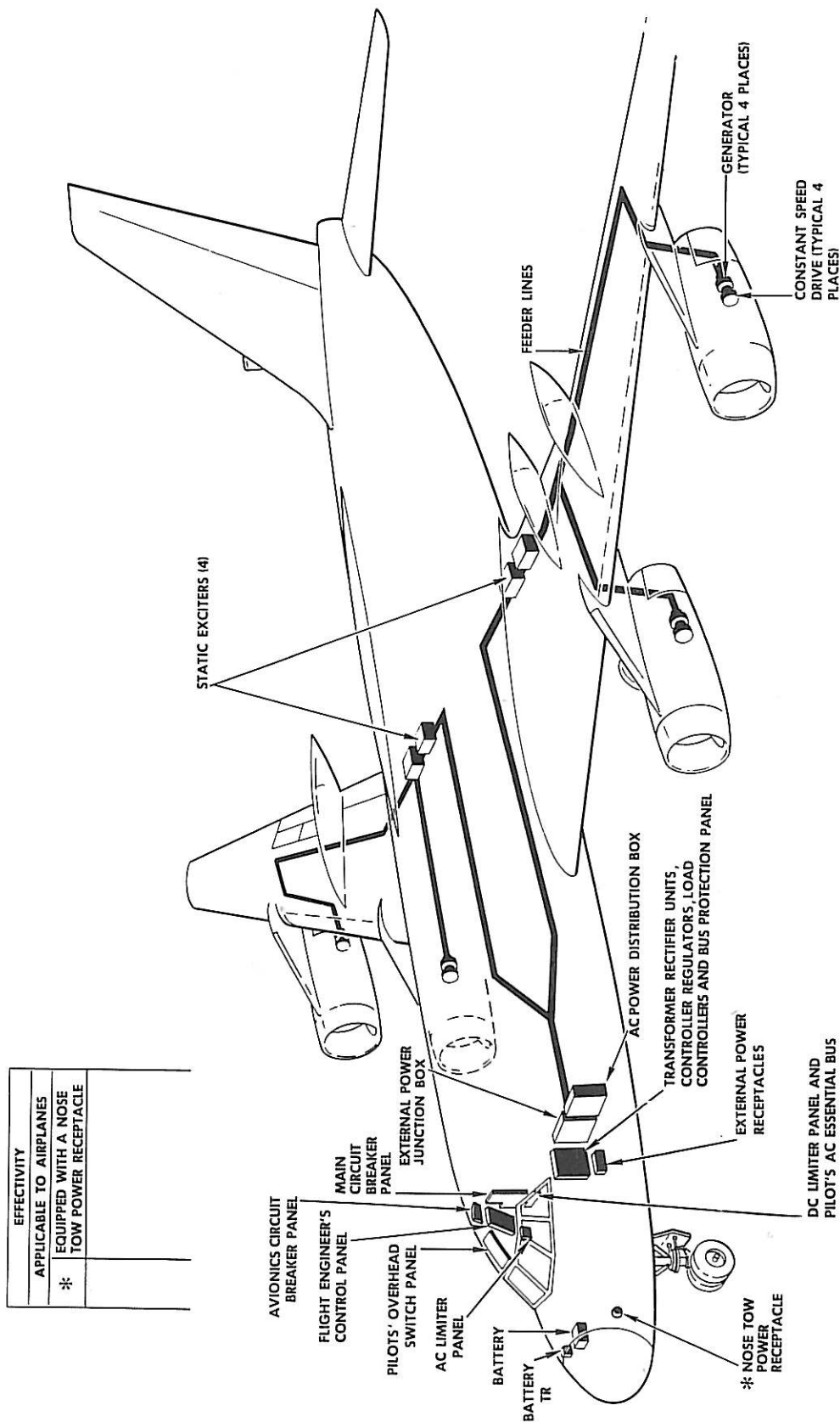
- A. Four constant speed drive (CSD) units which convert the variable input speed of the engine to a constant output speed to drive the ac generators.
- B. Four ac generators which develop a total power of 160 KVA (40 KVA per generator). The generators are driven at 6000 rpm by General Electric, hydraulic, constant speed drives which hold the generator speeds within specified rpm tolerances (and therefore within frequency tolerance).
- C. The static exciters which provide rectified feedback of generator output to excite the generator field windings.
- D. The controller-regulator units which perform voltage regulation, fault detection, paralleling and indicating functions.
- E. Generator line and bus tie contactors which make it possible to connect and/or isolate the generators to and from the load buses and synchronizing (sync) bus.
- F. The load buses which provide a centralized location from which subsystems can originate.
- G. The transformer-rectifier (T-R) units which enable the conversion of ac to dc power for circuit operations.
- H. Control switches which provide manual control in the event of a malfunction in the automatic system.

The components of the electrical system provide automatic operation, regulation, positive fault detection and protection. Although the generators normally operate in parallel, a fault in one generator system will not cause the remaining generators to stop furnishing power to the respective load bus and/or sync bus. The electrical system components installed in the electrical compartment are shown in Figure 2.

The flight engineer monitors and controls all manual controls for the system with the exception of the PILOTS' AC ESSENTIAL BUS SELECTOR switch. This selector switch enables the pilots to select any one of five alternate power sources for the pilots' ac essential bus.

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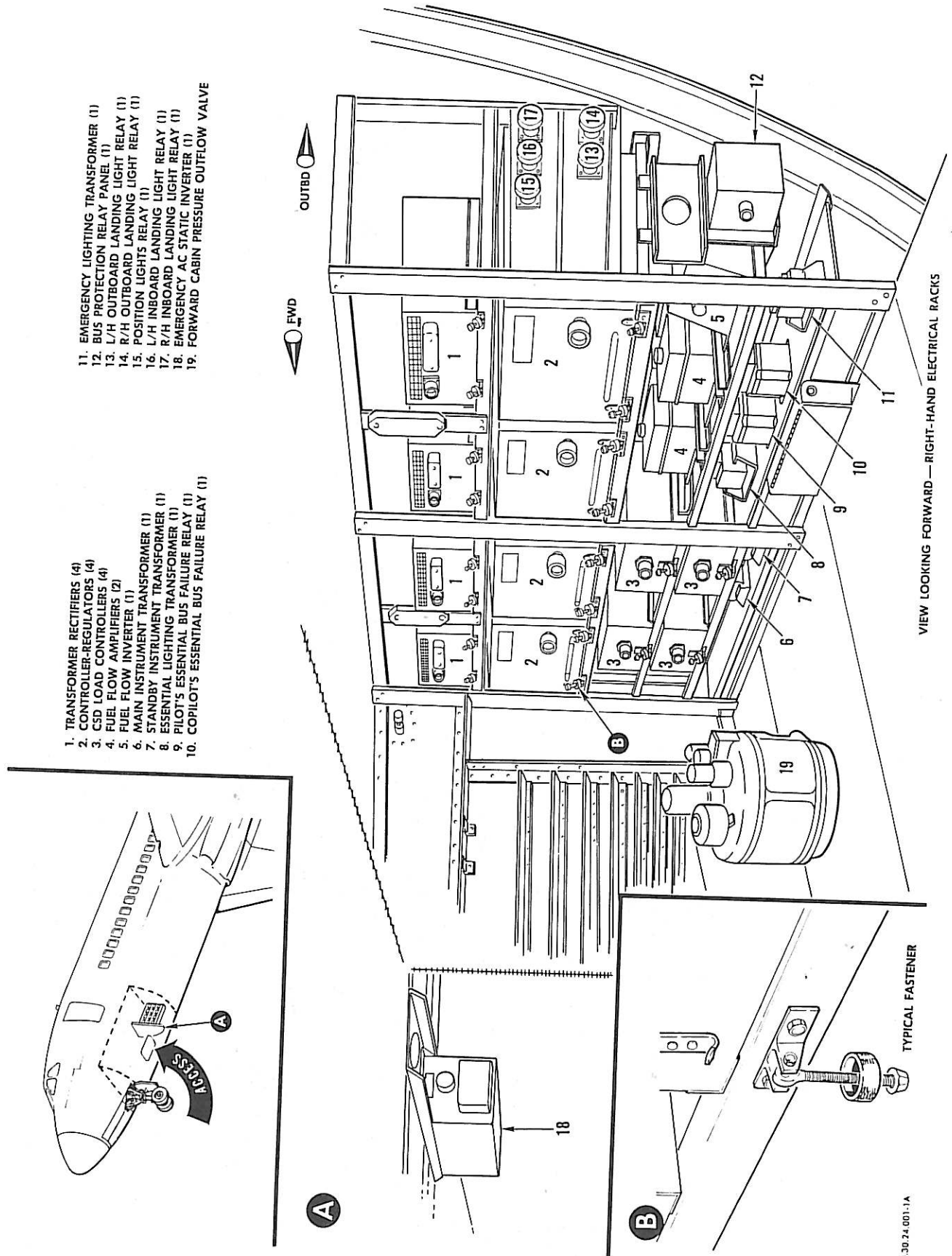
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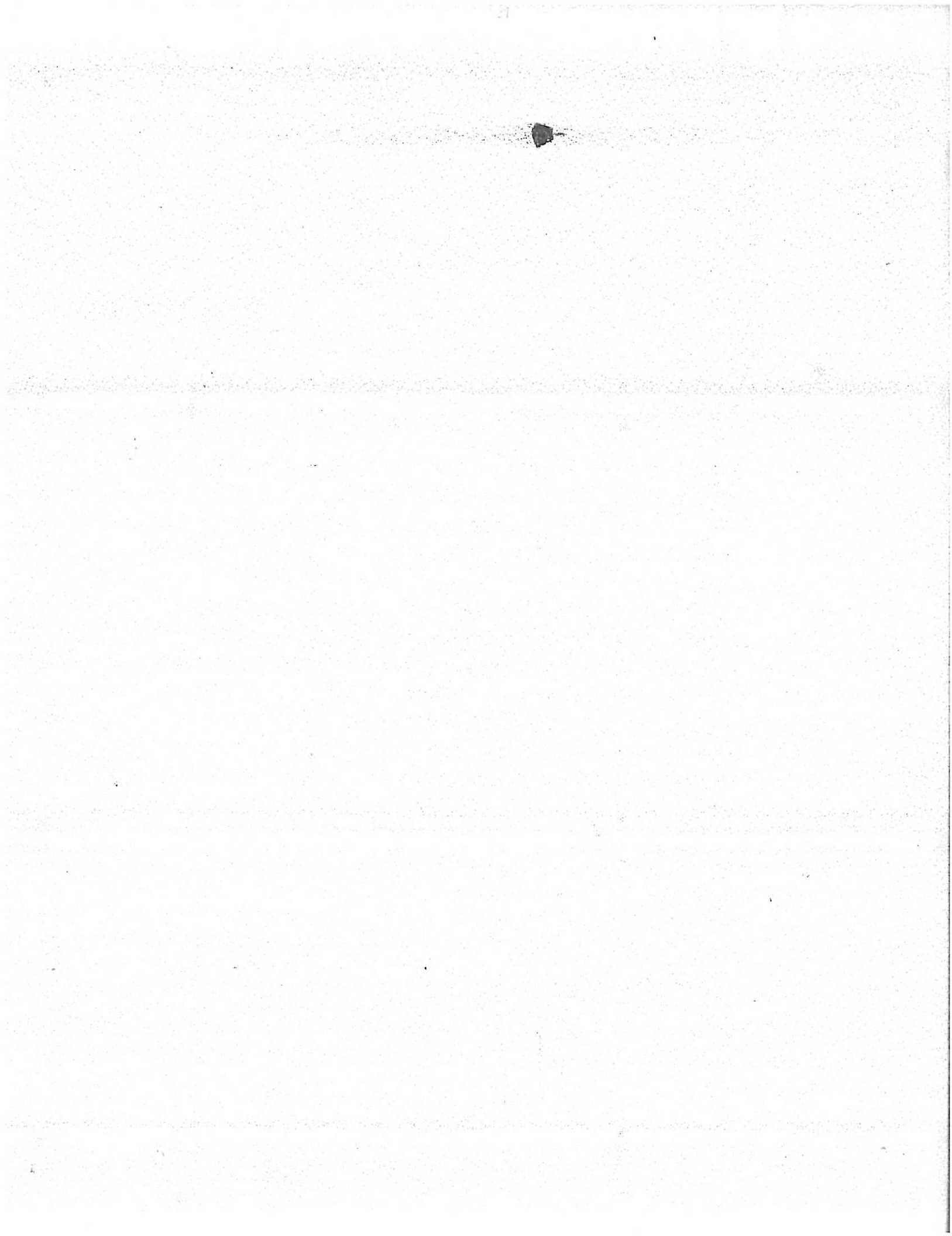
Electrical Power System
Figure 1

Aug. 30/61
AB-1

AC Power System Components
Figure 2 (Sheet 1 of 2)

24-0
Page 3





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The airplane has two external power receptacles for connecting external ac power for maintenance and engine start. An external ac power unit, connected to the external MAIN and AUXILIARY power receptacles, provides all the ac and dc power (through transformer-rectifier units) necessary to check the airplane systems. Normally, only the main receptacle is required; however, if full ground air conditioning or some system powered by the non-essential buses is required, the auxiliary receptacle must be connected. *A third, nose tow power receptacle provides power to a limited number of circuits while the airplane is being towed.

If a complete ac system malfunction occurs, dc power is supplied to the 28-volt emergency dc bus by the battery power system. During normal operation, the battery remains on a floating charge via its own transformer-rectifier unit. When the battery power system is needed, the battery switch is placed in the EMERG position. This switch action indirectly places battery power on the 28-volt emergency dc bus to which a limited number of essential dc circuits connect.

The primary electrical supply system consists of a 115/200-volt, 3-phase, 400-cycle, constant frequency ac system and a 28-volt dc system. The systems incorporate multiple buses for distribution. The systems provide 100 percent standby for essential power with all generators operating, and provide 100 percent normal power after the malfunctioning of one ac generator. Normal dc power is derived from four, 50-ampere transformer-rectifiers whose inputs connect to the No. 1, 2, 3, and the pilots' ac essential bus. A 20-ampere transformer-rectifier unit keeps the battery charged. A sixth unit, rated at 50 amperes, provides dc power control when external power is connected. Except for certain special circuits, the airplane power serves as a ground return for the electrical circuits.

2. Electrical System Ratings

- A. Number of Wires..... 4
- B. Connection..... Wye (grounded neutral)
- C. Voltage..... 115/200
- D. Phases..... Three
- E. Frequency..... 400-cps
- F. System Capacity..... 160-KVA Maximum (continuous)
- G. System Operation..... Parallel or Isolated

3. Airplane Electrical Circuits

The following sections apply only to the power supply, distribution and related instrument and control circuits; many circuits receive this generated power for operation. The following is an alphabetical list of the circuits.

*Applicable to airplanes equipped with a nose tow power receptacle.

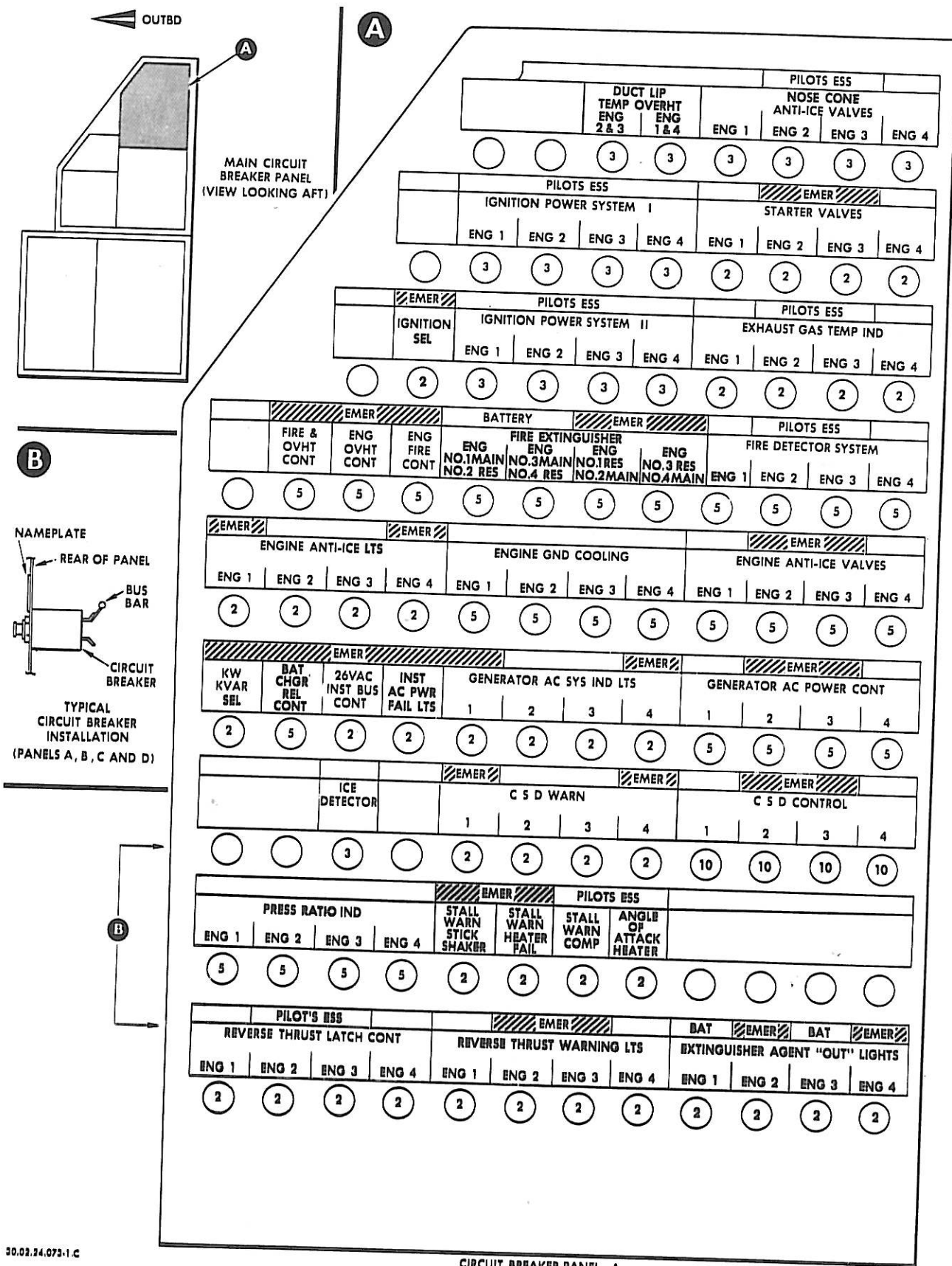
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Directly across from each circuit title is a reference to the chapter in which a description or schematic of the particular circuit can be found. Figure 3 shows the main circuit breaker panel where the majority of the electrical circuits originate. Refer to Chapter 23, COMMUNICATIONS for an illustration of the avionics circuit breaker panel.

<u>CIRCUIT TITLE</u>	<u>CHAP</u>	<u>CHAPTER TITLE</u>
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AC Power Circuit	24	ELECTRICAL POWER
AC Power Distribution	24	ELECTRICAL POWER
AC Voltmeter-Ammeter	24	ELECTRICAL POWER
Airflow Indicator	21	AIR CONDITIONING
Aldis Lamp	33	LIGHTS
Altimeter Vibrator	34	NAVIGATION
Altitude Warning Lights	21	AIR CONDITIONING
Anticollision Lights	33	LIGHTS
Anti-Ice Structural Temperature		
and Overheat Warning	30	ICE AND RAIN PROTECTION
Anti-Shock Body Warning	31	INSTRUMENTS
Antiskid Control	32	LANDING GEAR
Autopilot	22	AUTOPILOT
Bleed Air Cross Over Duct		
Pressure	36	PNEUMATIC
Bleed Air Duct Isolation	36	PNEUMATIC
Buffet Area Lights	33	LIGHTS
Buffet Power	25	EQUIPMENT/FURNISHINGS
Cabin Air Conditioning	21	AIR CONDITIONING
Cabin General Lights	33	LIGHTS
Cabin Pressurization	21	AIR CONDITIONING
Cabin Temperature Equalizing	21	AIR CONDITIONING
Cabin Temperature Indicating	21	AIR CONDITIONING
Cargo Compartment Lights	33	LIGHTS
Coat Closet Lights	33	LIGHTS
Cockpit Dome Lights	33	LIGHTS
Cockpit Slide and Aft Window		
Defog	30	ICE AND RAIN PROTECTION
Cockpit White Floodlights	33	LIGHTS
Console and Floodlights	33	LIGHTS
CSD Control and Warning	24	ELECTRICAL POWER
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Electric Shaver Circuit	25	EQUIPMENT/FURNISHINGS
Elevator Downspring Circuit	27	FLIGHT CONTROL
Emergency Lights	33	LIGHTS

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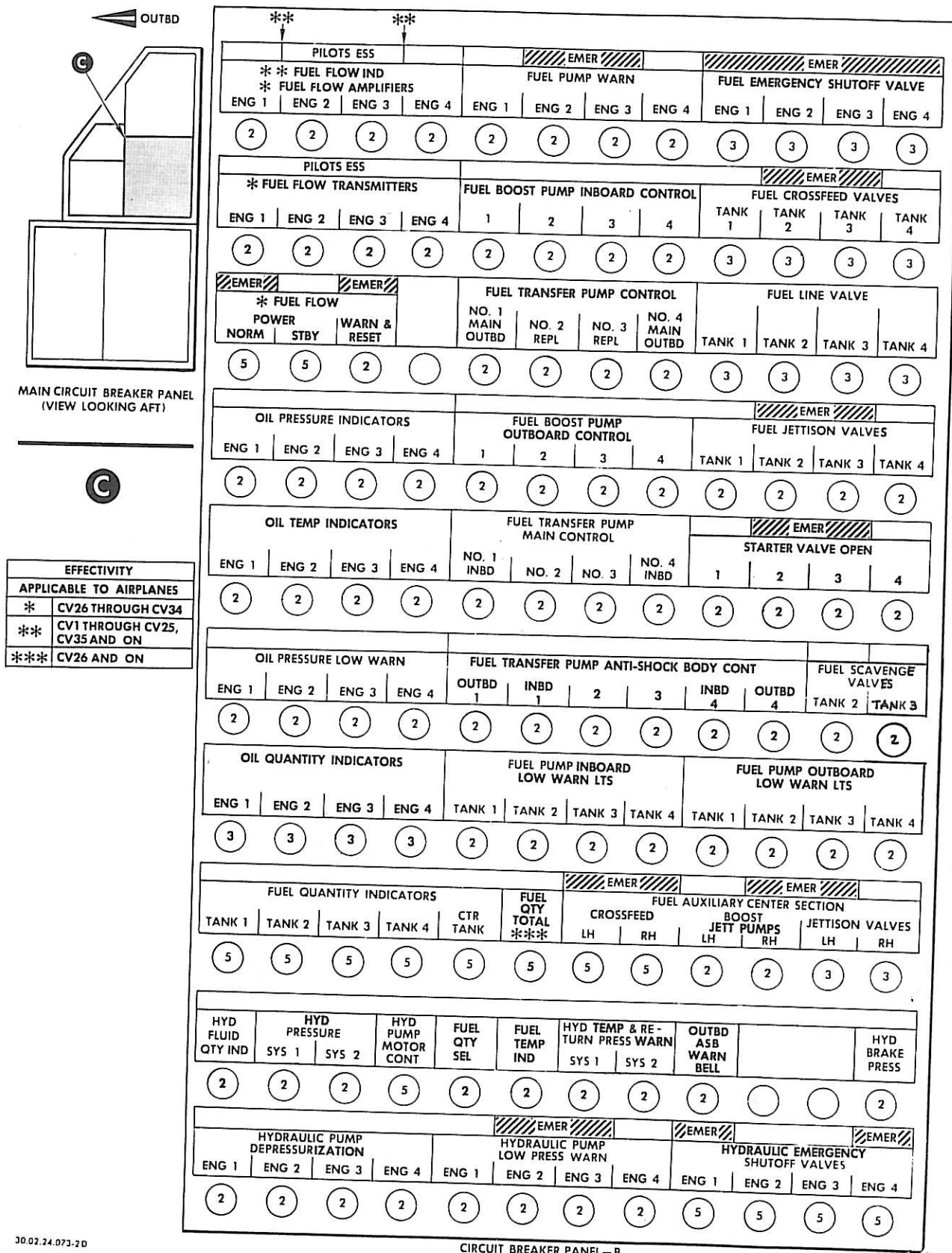


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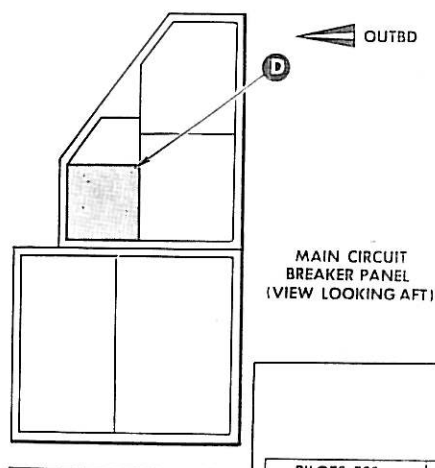
Main Circuit Breaker Panel
Figure 3 (Sheet 1 of 9)

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CIRCUIT BREAKER PANEL-B

Main Circuit Breaker Panel
Figure 3 (Sheet 2 of 9)



EFFECTIVITY	
APPLICABLE TO AIRPLANES	
	CV1 THROUGH CV25
*	CV3, CV4 AND CV25

CIRCUIT BREAKER PANEL - C

NAV-RO LT CONT *	*
2	

PILOTS ESS						EMER			PILOTS ESS										
INST PANEL LIGHTS						FLARE RELEASE			CONSOLE PANEL LIGHTS		FLIGHT ENGINEER		PEDESTAL & OVHD PNL LTS		INST PNL HI-INTENSITY FLOOD LTS		PILOTS OVERRIDE PASS LTS		
WHITE			RED						LH		RH		PANEL LTS		FLOOD LTS				
PILOT			COPILOT																
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
2			2			2			10			3		3		3		7.5	
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2			2			2			10			3		3		3		7.	

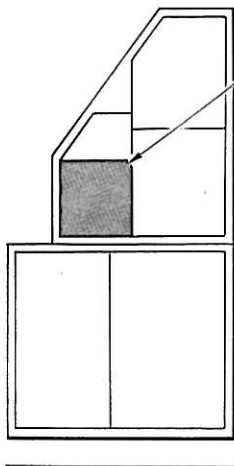
30 30 24 021 3D

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AB-4

Main Circuit Breaker Panel
Figure 3 (Sheet 3 of 9)

CONVAIR MODEL 30

MAINTENANCE MANUAL



MAIN CIRCUIT
BREAKER PANEL
(VIEW LOOKING AFT)

OUTBD

D

EFFECTIVITY	
APPLICABLE TO AIRPLANES	
	CV26 AND ON
*	CV35 AND ON

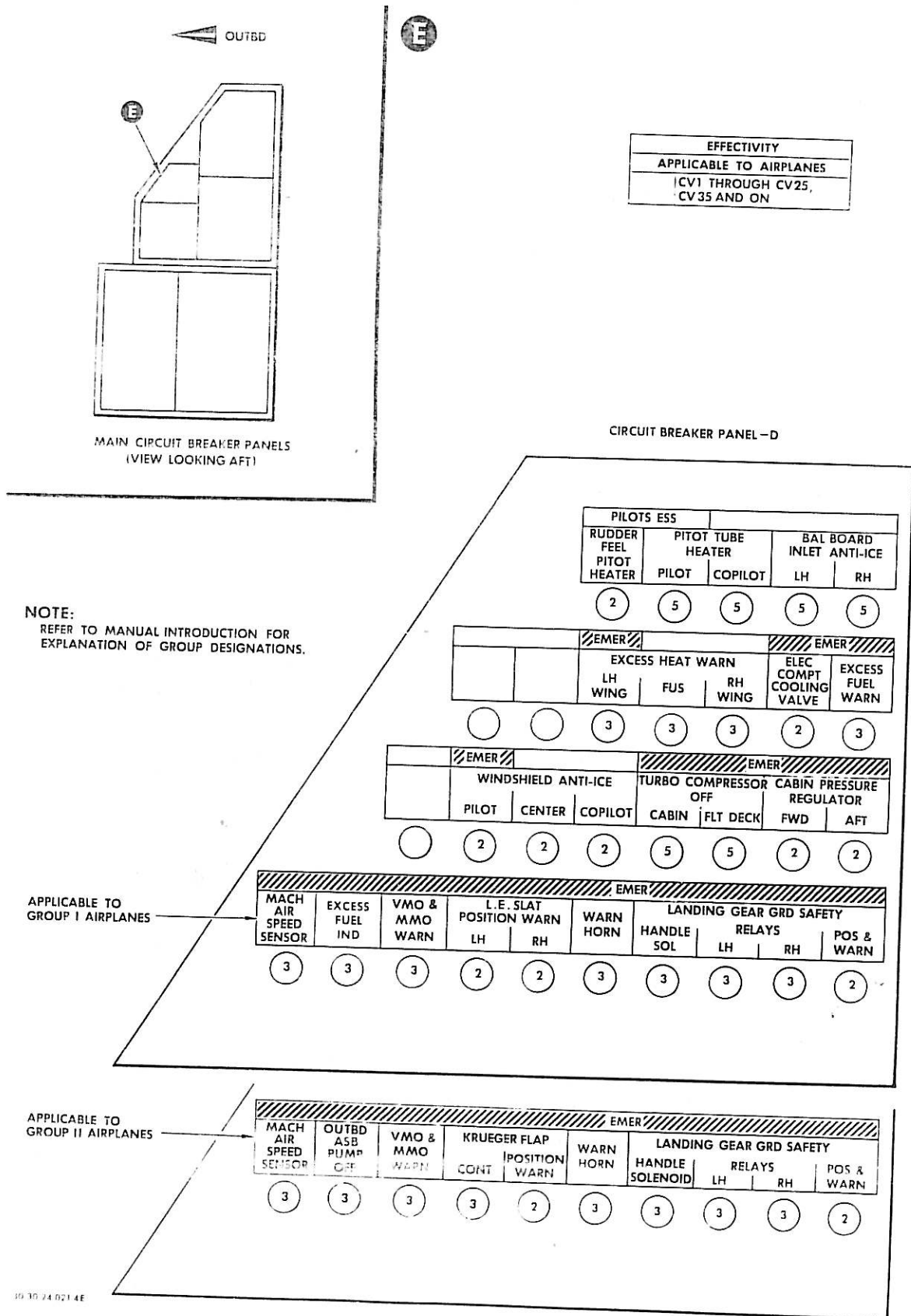
CIRCUIT BREAKER PANEL - C

* CABIN LTS	
L.H.	R.H.
7.5	7.5

PILOTS ESS				EMER	PILOTS ESS							
INST PANEL LIGHTS		INTEGRAL		FLARE RELEASE	CONSOLE PANEL LTS		FLIGHT ENGR		PED & OVHD PNL LTS	INST PNL HI- INTENSITY FLOOD LTS	PILOTS OVERRIDE PASS LTS	
FLOOD	WHITE	PILOT & CNTR	COPILOT		LH	RH	PANEL LTS	FLOOD LTS				
2	2	2	2	10	3	3	3	3	7.5	2	2	
PILOTS ESS				EMER	PILOTS ESS							
EMER LIGHTS		CABIN LTS		CABIN LIGHT CONT	NAV-RO LT CONT	POSITION LIGHTS	MAG COMPASS LIGHT	ALDIS LAMP OUTLET	DOOR OPEN WARN LTS	MASTER WARN CONT & A. P. OFF	MASTER WARN	
FWD	AFT											
2	10	10	5	2		7.5	2	7.5	2	10	3	
PILOTS ESS				EMER	PILOTS ESS							
EMER LTS CHARGER	ANTI-COLLISION LIGHTS		INBOARD LANDING LIGHTS		OUTBOARD LANDING LIGHTS		NIGHT LIGHTS	TAXI LTS				
	UPPER	FWD LOWER	AFT LOWER	CONT	LH	RH	LH	RH	WARN			
2	3	3	3	2	7.5	7.5	7.5	7.5	2	3	5	
EMER BATTERY				EMER	EMER							
EMER HAND LTS	EMER & DOME LTS	MAP READING LTS	26V AC LTG TRANS CONT	WHEEL WELL & PYLON LTS	E & E COMPT LTS	AIR COND & HYD COMPT LTS	FWD CARGO COMPT LTS	AFT CAR- GO & TAIL COMPT LTS	LAV OCCUP WARN LTS	STEWARDESS PNL		
										FWD	AFT	
5	5	5	15	5	5	5	5	7.5	5	15	15	
ELEC SHAVER	LAV LTS	FLT DECK DOME LT	CKT BKR PANEL LTS	AUTO PLT TRIM RATE LIMIT (MECH)	STAB TRIM RATE CONT	MANUAL STAB TRIM	PILOTS ESS		SPEED STABILITY	EMER		
							AC	DC		SPOILER DE-ACTIVATION		
3	5	5	2	5	5	5	2	2		5	5	
EMER				EMER	PILOTS ESS							
FLAP ASYM CONT	STAB TRIM CONT EMER	FLAP & AIL WARN LTS	FLAP POS IND	STAB POS IND	REMOTE PILOT	COMPASS DC COPILOT	ALTI- METER THUMPER	YAW DAMPER	AUTO PILOT	AUTO PLT TRIM & TRIM RATE LIMIT (HYD)	ELEVATOR DOWN- SPRING	
3	5	2	2	2	2	2	2	5	7.5	5	2	
PILOTS ESS		PILOTS ESS		PILOTS ESS		PILOTS ESS						
TURN & BANK IND	AIR DATA FLIGHT INST	PILOT	COPILOT	REMOTE COMPASS	PILOT	COPILOT	FLIGHT DIRECTOR COMPUTER	VERT GYRO NO. 1	NAVIGATION INST AMPL		VERT GYRO NO. 2	
									PILOT	COPILOT		
2	2	2	2		2	2	2	2	2	2	2	

* BOTH HORIZ WARN OFF	
	2

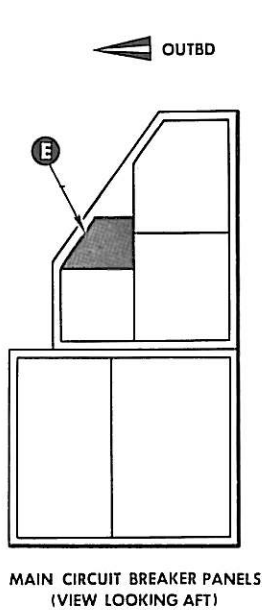
30.02.24.073-3 D



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AP-44

Main Circuit Breaker Panel
Figure 3 (Sheet 5 of 9)

MAINTENANCE MANUAL



E

EFFECTIVITY	
APPLICABLE TO AIRPLANES	
CV26 THROUGH CV34	

NOTE:
REFER TO MANUAL INTRODUCTION FOR
EXPLANATION OF GROUP DESIGNATIONS.

CIRCUIT BREAKER PANEL - D

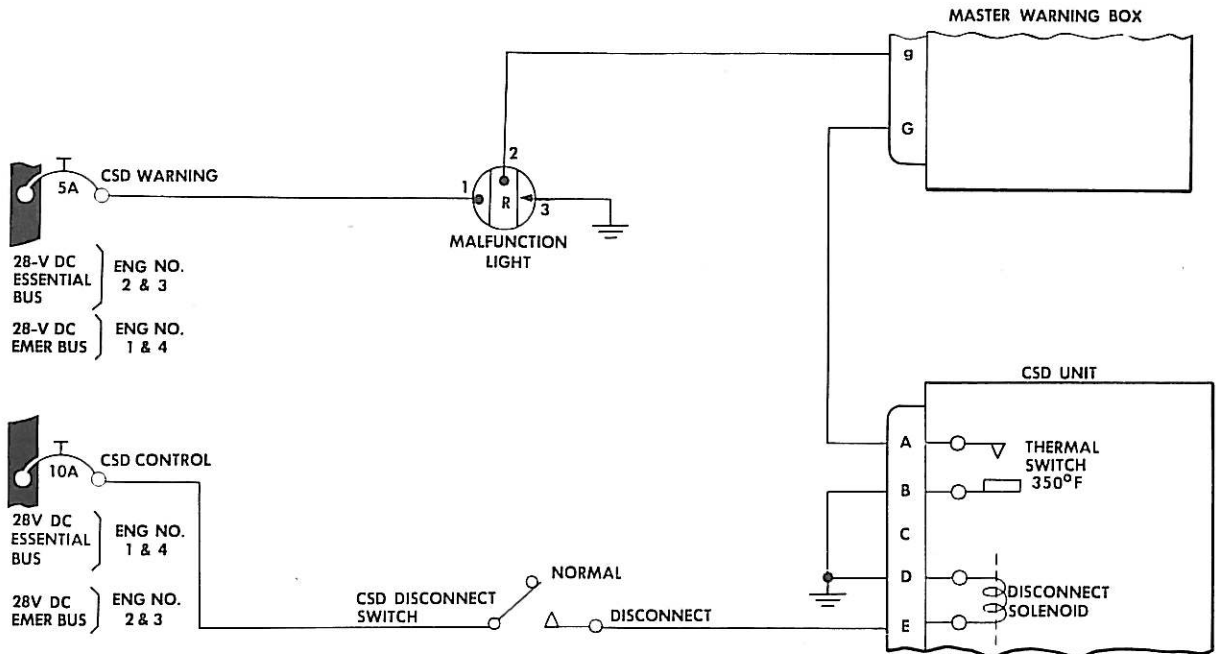
APPLICABLE TO
GROUP I AIRPLANES

EMER		EMER		EMER		EMER		EMER		EMER	
MACH AIR SPEED SENSOR	EXCESS FUEL IND	VMO & MMO WARN	L.E. SLAT POSITION WARN	WARN HORN	HANDLE SOLENOID	GRD SAFETY RELAYS	POS & WARN	LH	RH	LH	RH
3	3	3	2	2	3	3	3	3	3	3	2

APPLICABLE TO
GROUP II AIRPLANES

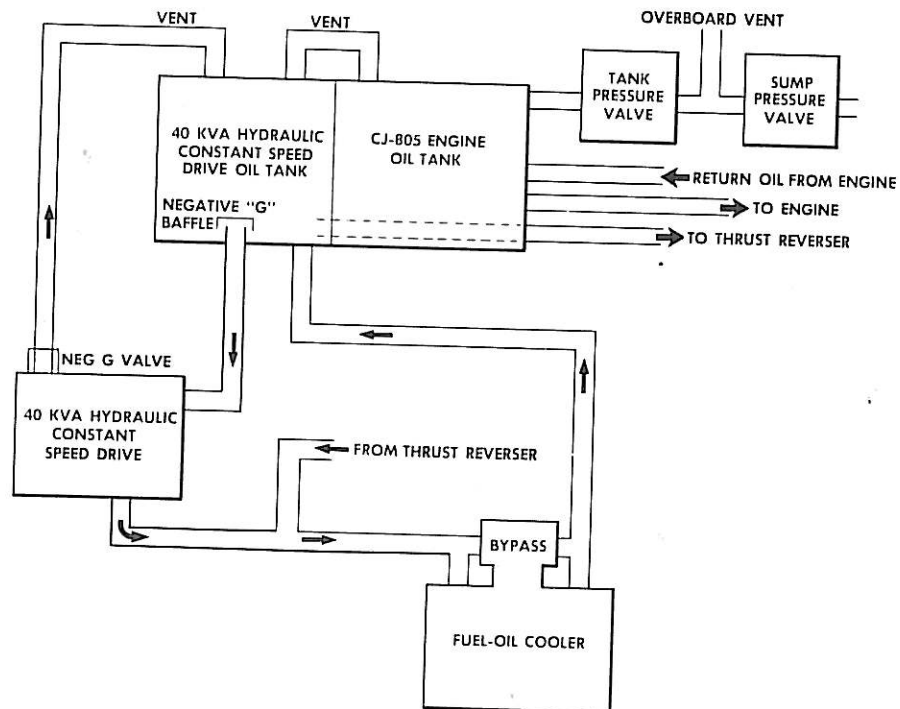
EMER		EMER									
MACH AIR SPEED SENSOR	OUTBD ASB PUMP OFF	VMO & MMO WARN	KRUEGER FLAP		WARN HORN	LANDING GEAR					POS & WARN
			CONT	POSITION WARN		HANDLE SOLENOID	GRD SAFETY RELAYS				
							LH	RH			
3	3	3	3	2	3	3	3	3	3		2

30.02.24.073-4D

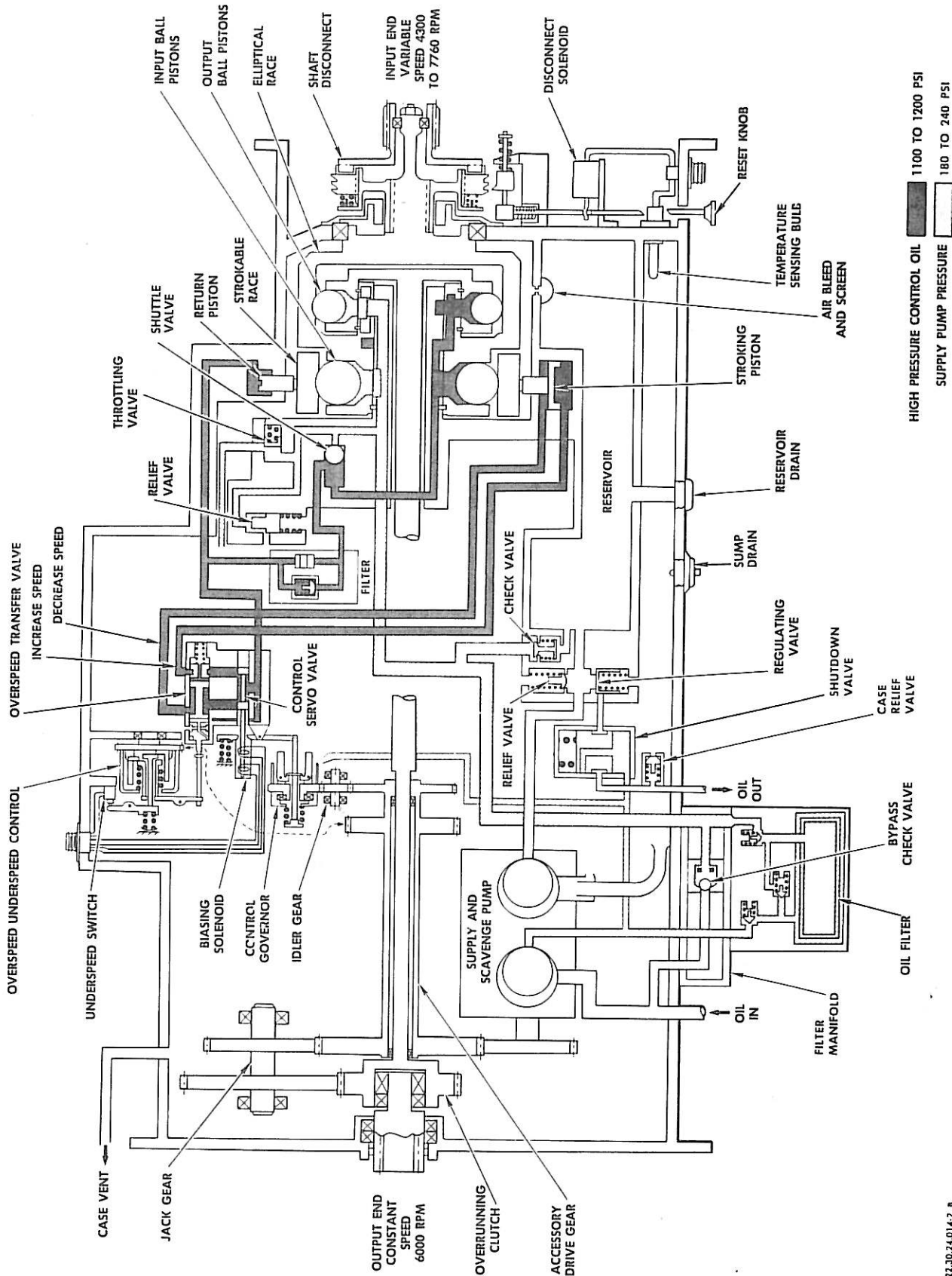


30.30.24.022A

CSD Warning Schematic
Figure 12

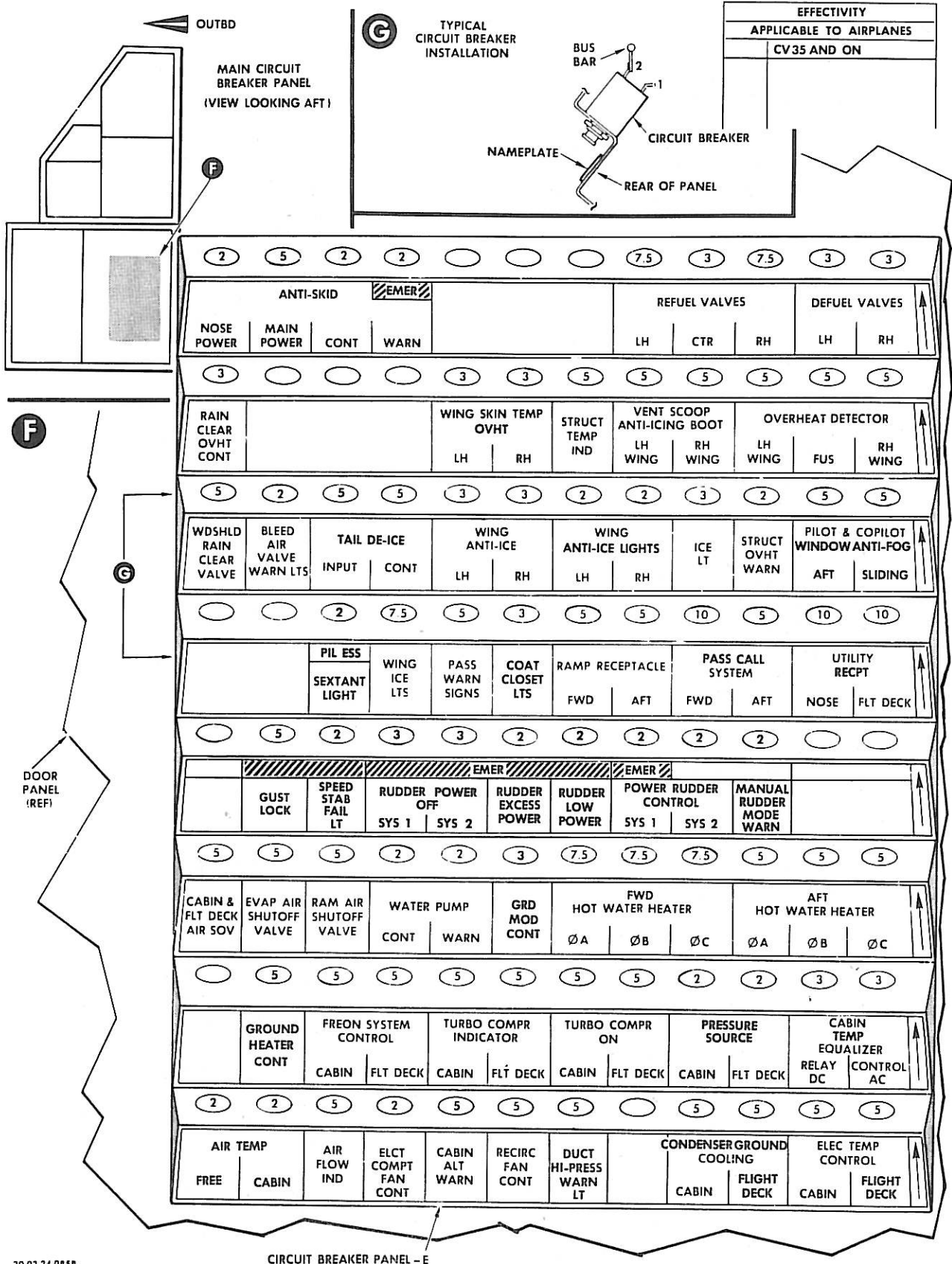


22.02.24.153A



22.30.24.014.2 B

MAINTENANCE MANUAL



30.02.24.083B

Sep. 10/63
AB-3

Main Circuit Breaker Panel
Figure 3 (Sheet 9 of 9)

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MAINTENANCE MANUAL

<u>CIRCUIT TITLE</u>	<u>CHAP</u>	<u>CHAPTER TITLE</u>
Emergency Pressure	21	AIR CONDITIONING
Engine Air Anti-Ice	75	AIR
Engine Bleed Air	36	PNEUMATIC
Engine Fuel Pump Warning	77	ENGINE INDICATION
Engine Ground Cooling	77	ENGINE INDICATION
Engine Oil Pressure Indicator	77	ENGINE INDICATION
Engine Oil Pressure Low Warning	77	ENGINE INDICATION
Engine Start and Ignition	74	IGNITION
Engine Oil Temperature Indicator	77	ENGINE INDICATION
Excess Fuel Indicator	28	FUEL
Exhaust Temperature Indicator	77	ENGINE INDICATION
Fan Tachometer Indicator	77	ENGINE INDICATION
Fire Extinguisher	26	FIRE PROTECTION
Fire Warning	26	FIRE PROTECTION
Flap Asymmetric Control	27	FLIGHT CONTROL
Flap Position Indicator	27	FLIGHT CONTROL
Flap Setting vs Airspeed Warning	27	FLIGHT CONTROL
Flare Release	25	EQUIPMENT/FURNISHINGS
Flight Air Data Instruments	34	NAVIGATION
Flight Engineer's Panel Lights	33	LIGHTS
Flight Navigation Instruments	34	NAVIGATION
Flight Recorder	31	INSTRUMENTS
Free Air Temperature Indicator	31	INSTRUMENTS
Front Spar Ventilating Scoop Anti-Ice	30	ICE AND RAIN PROTECTION
Fuel Boost Pumps	28	FUEL
Fuel Control	28	FUEL
Fuel Flow Indicator	77	ENGINE INDICATION
Fuel Quantity Indicator	28	FUEL
Fuel Temperature Indicator	77	ENGINE INDICATION
Fuel Transfer Pumps	28	FUEL
Hydraulic Brake Pressure Indicator	32	LANDING GEAR
Hydraulic Fluid Quantity Indicator	29	HYDRAULIC POWER
Hydraulic Oil Temperature Indicator	29	HYDRAULIC POWER
Hydraulic Pressure Indicator	29	HYDRAULIC POWER
Hydraulic Pressure Low Warning	29	HYDRAULIC POWER
Hydraulic Pump Control	29	HYDRAULIC POWER
Hydraulic Pump Depressuriza- tion	29	HYDRAULIC POWER
Hydraulic Valve Control	29	HYDRAULIC POWER
Ice Detector System	30	ICE AND RAIN PROTECTION
Inboard Landing Lights	33	LIGHTS
Inboard/Outboard Spoiler Control	27	FLIGHT CONTROL
Instrument Panel Lights	33	LIGHTS
Integral Instrument Lights	33	LIGHTS

MAINTENANCE MANUAL

<u>CIRCUIT TITLE</u>	<u>CHAP</u>	<u>CHAPTER TITLE</u>
**Krueger Flap	27	FLIGHT CONTROL
Landing Gear Control	32	LANDING GEAR
Landing Gear Ground Safety	32	LANDING GEAR
Landing Gear Position and Warning	32	LANDING GEAR
Leading Edge Slats Position Lights	27	FLIGHT CONTROL,
*Lounge Overhead Lights	33	LIGHTS
Lavatory Hot Water	38	WATER/WASTE
Lavatory Lights	33	LIGHTS
Magnetic Compass Light	33	LIGHTS
Map Reading Lights	33	LIGHTS
Master Warning	31	INSTRUMENTS
NACA Flight Recorder	31	INSTRUMENTS
Navigator/Radio Operator Lights	33	LIGHTS
Oil Quantity Indicator	77	ENGINE INDICATION
Outboard Landing Lights	33	LIGHTS
Overhead Switch Panel and Pedestal Lights	33	LIGHTS
Passenger Call Lights	23	COMMUNICATIONS
Passenger Entrance Lights	33	LIGHTS
Passenger Reading Lights	33	LIGHTS
Passenger Warning Signs	25	EQUIPMENT/FURNISHINGS
Passenger Water System	38	WATER/WASTE
Pitot Heaters	30	ICE AND RAIN PROTECTION
Position Lights	33	LIGHTS
Pressure Board Inlet Anti-Ice	30	ICE AND RAIN PROTECTION
Pressure Ratio Indicator	77	ENGINE INDICATION
Refuel-Defuel Control	28	FUEL
Remote Compass	34	NAVIGATION
Reverse Thrust	77	ENGINE INDICATION
Rudder Feel Pitot Heater	30	ICE AND RAIN PROTECTION
Speed Brake Warning	27	FLIGHT CONTROL
Speed Stability Augmentation	27	FLIGHT CONTROL
Stabilizer Position Indicator	27	FLIGHT CONTROL
Stabilizer Trim Control	27	FLIGHT CONTROL
Stabilizer Trim Emergency Shutoff	27	FLIGHT CONTROL
Stabilizer Trim Rate Control	27	FLIGHT CONTROL
Stewardess Switch Panel Lights	33	LIGHTS
Tachometer Indicator	77	ENGINE INDICATION
Tail Deice	30	ICE AND RAIN PROTECTION
Tank Fuel Pump Warning	28	FUEL
Taxi Lights	33	LIGHTS
Thrust Indicator	77	ENGINE INDICATION
Turbo Compressor Bearing Temperature Indicator	21	AIR CONDITIONING

*Applicable to Airplanes CV1 Through CV34.

**Applicable for Group II Airplanes. Refer to INTRODUCTION for Explanation of Group Designations.

MAINTENANCE MANUAL

<u>CIRCUIT TITLE</u>	<u>CHAP</u>	<u>CHAPTER TITLE</u>
Turbo Compressor RPM Indicator	21	AIR CONDITIONING
Turn and Slip Indicator	34	NAVIGATION
VMO-MMO Warning	31	INSTRUMENTS
Warning Horn	32	LANDING GEAR
Warning Light Dimming	31	INSTRUMENTS
Wheel Well and Pylon Lights	33	LIGHTS
Windshield Anti-Ice and Defog	30	ICE AND RAIN PROTECTION
Windshield Rain Clear	30	ICE AND RAIN PROTECTION
Wing Anti-Ice	30	ICE AND RAIN PROTECTION
Wing Ice Lights	33	LIGHTS

4. Interchangeability of Relays On The Station 306 Relay Panel (see Figure 4)

A. General.

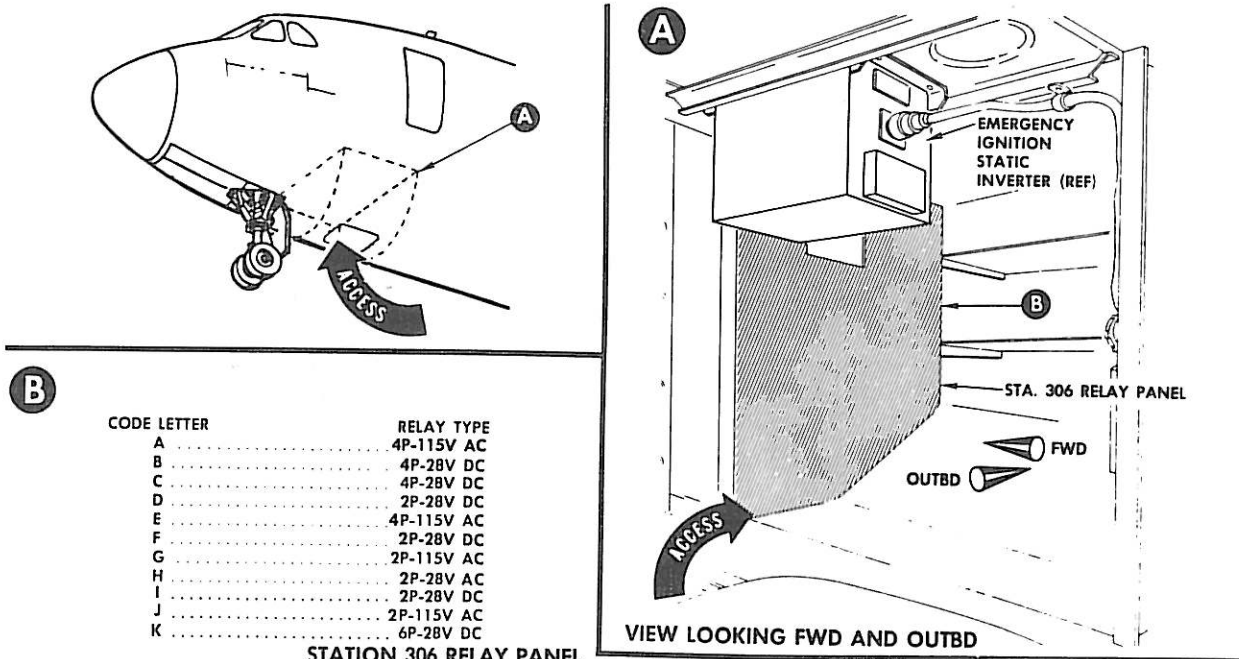
Certain relays on the station 306 relay panel may be interchanged to aid maintenance personnel during electrical troubleshooting. If a relay is suspected to be faulty, it may be substituted by a relay with the same code letter. Locate the relay in question and determine its code letter by using Figure 4 and list of relays.

CAUTION: COMPARE MANUFACTURERS PART NUMBERS ON RELAYS BEFORE MAKING A SUBSTITUTION.

NOTE: Replace relays in original position after making test.

B. List of Relays.

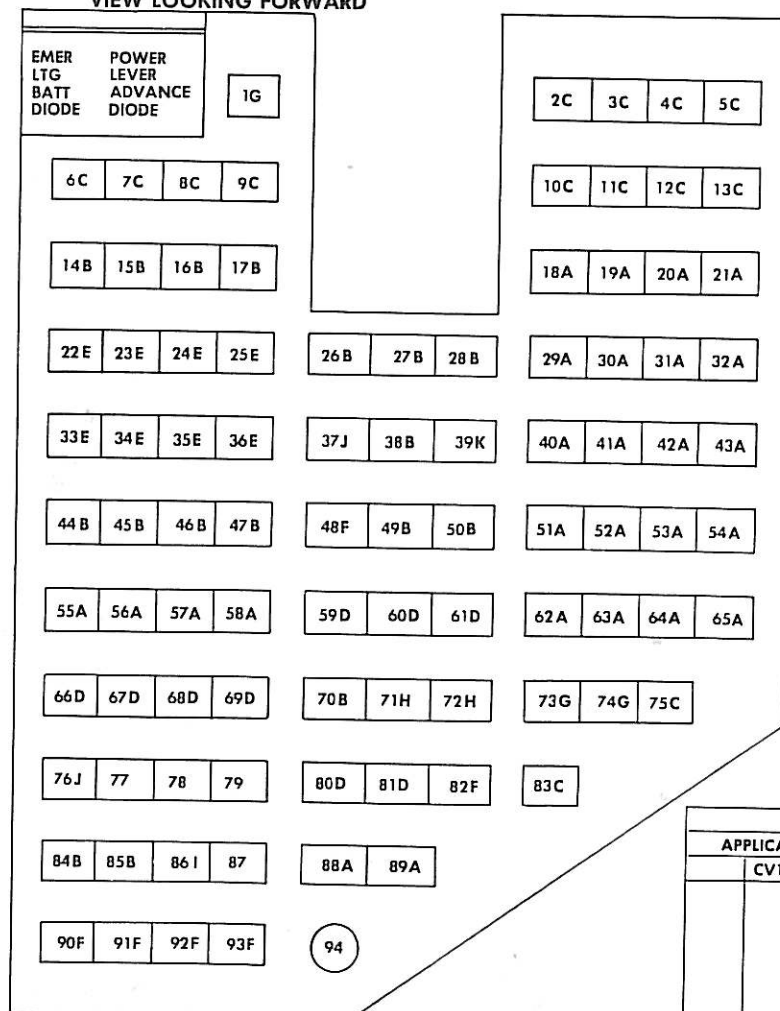
- (1) Emergency Lights Transfer Relay
- (2) Left-hand Landing Gear Ground Safety Relay No. 1
- (3) Left-hand Landing Gear Ground Safety Relay No. 2
- (4) Left-hand Landing Gear Ground Safety Relay No. 3
- (5) Left-hand Landing Gear Ground Safety Relay No. 4



B

CODE LETTER	RELAY TYPE
A	4P-115V AC
B	4P-28V DC
C	4P-28V DC
D	2P-28V DC
E	4P-115V AC
F	2P-28V DC
G	2P-115V AC
H	2P-28V AC
I	2P-28V DC
J	2P-115V AC
K	6P-28V DC

**STATION 306 RELAY PANEL
VIEW LOOKING FORWARD**



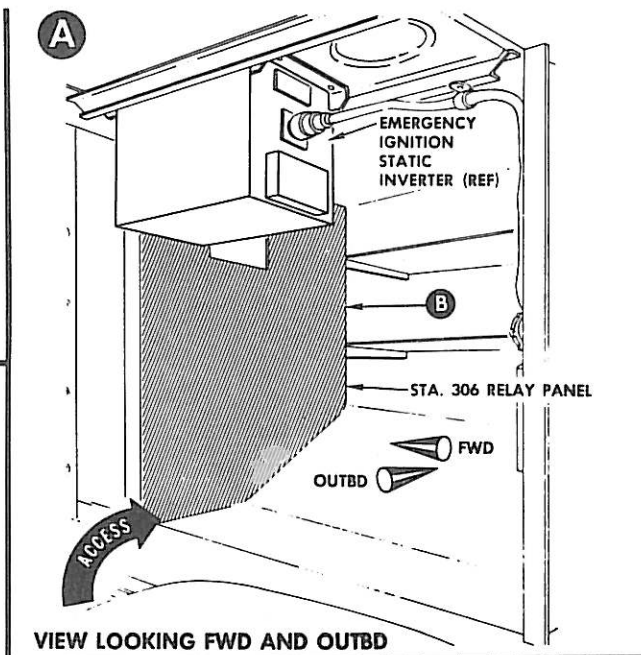
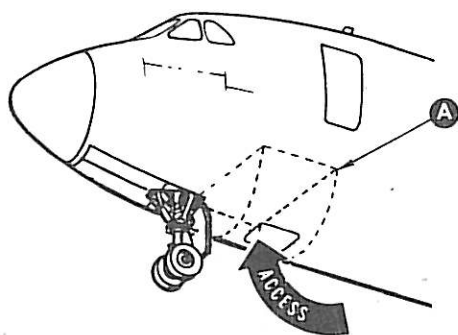
30.02.24.083-1A

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AB-2

Station 306 Relay Panel
Figure 4 (Sheet 1 of 2)

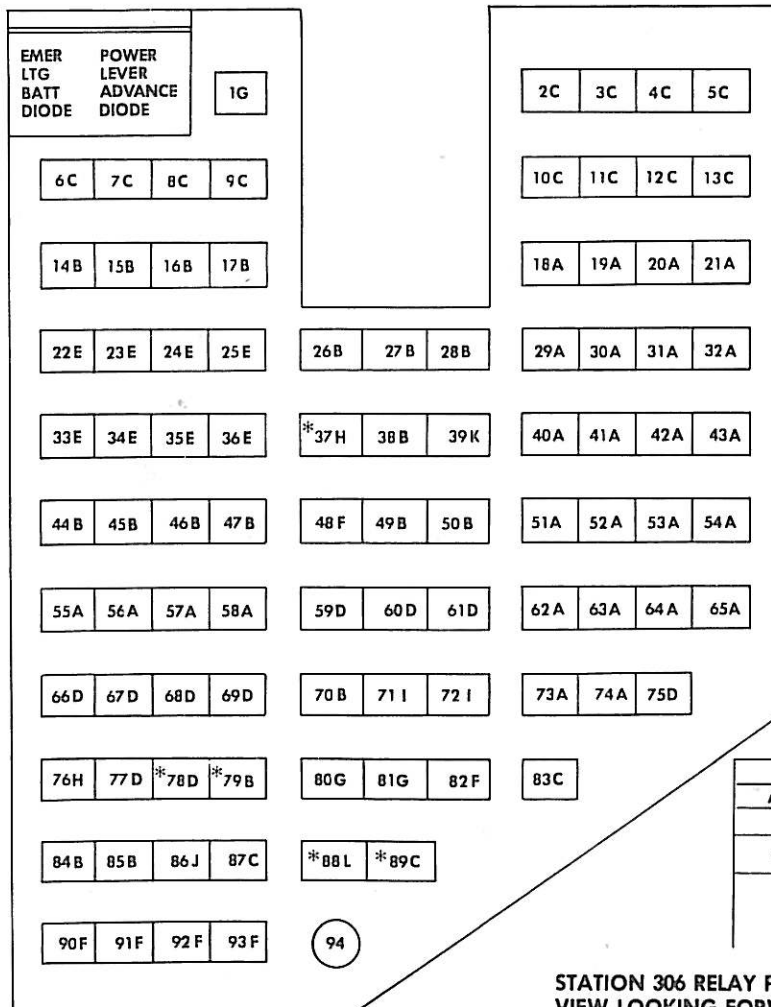
24-0
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MAINTENANCE MANUAL



B

CODE LETTER	RELAY TYPE
A	4P-115V AC
B	4P-28V DC
C	4P-28V DC
D	2P-28V DC
E	4P-115V AC
F	2P-28V DC
G	2P-115V AC
H	2P-115V AC
I	2P-28V AC
J	2P-28V DC
K	6P-28V DC
L	2P-115V AC



EFFECTIVITY	
APPLICABLE TO AIRPLANES	
	CV26 AND ON
*	CV26 THROUGH CV34

STATION 306 RELAY PANEL
VIEW LOOKING FORWARD

30.02.24.003-7A

MAINTENANCE MANUAL

- (6) Power Lever Advance Relay Landing Gear Control No. 1
- (7) Power Lever Advance Relay Landing Gear Control No. 2
- (8) Power Lever Advance Relay Landing Gear Control No. 3
- (9) Power Lever Advance Relay Landing Gear Control No. 4
- (10) Right-hand Landing Gear Ground Safety Relay No. 1
- (11) Right-hand Landing Gear Ground Safety Relay No. 2
- (12) Right-hand Landing Gear Ground Safety Relay No. 3
- (13) Right-hand Landing Gear Ground Safety Relay No. 4
- (14) Power Lever Retard Relay No. 1
- (15) Power Lever Retard Relay No. 2
- (16) Power Lever Retard Relay No. 3
- (17) Power Lever Retard Relay No. 4
- (18) Fuel Transfer Pump Relay - Tank 1 Inboard
- (19) Fuel Transfer Pump Relay - Tank 1 Outboard
- (20) Fuel Transfer Pump Relay - Tank 2 Main
- (21) Fuel Transfer Pump Relay - Tank 2 Replenish
- (22) System 1 Engine Start Relay - Engine 1
- (23) System 1 Engine Start Relay - Engine 2
- (24) System 1 Engine Start Relay - Engine 3
- (25) System 1 Engine Start Relay - Engine 4
- (26) Master Warning Reset Relay
- (27) Nose Landing Gear Anti-Skid Control Relay
- (28) Main Landing Gear Anti-Skid Control Relay
- (29) Fuel Transfer Pump Relay - Tank 3 Main
- (30) Fuel Transfer Pump Relay - Tank 3 Replenish
- (31) Fuel Transfer Pump Relay - Tank 4 Inboard
- (32) Fuel Transfer Pump Relay - Tank 4 Outboard
- (33) System 2 Engine Start Relay - Engine 1
- (34) System 2 Engine Start Relay - Engine 2
- (35) System 2 Engine Start Relay - Engine 3
- (36) System 2 Engine Start Relay - Engine 4
- (37) *Auxiliary Hydraulic Pump Power Control Relay
- (37) **Blank
- (38) Generator Parallel Relay No. 1
- (39) Generator Parallel Relay No. 2
- (40) Anti-Shock Body Fuel Transfer Pump Relay No. 1 Inboard
- (41) Anti-Shock Body Fuel Transfer Pump Relay No. 2
- (42) Anti-Shock Body Fuel Transfer Pump Relay No. 3
- (43) Anti-Shock Body Fuel Transfer Pump Relay No. 4 Inboard
- (44) Ignition System Select Relay - Engines 1 & 2 System 1
- (45) Ignition System Select Relay - Engines 1 & 2 System 2
- (46) Ignition System Select Relay - Engines 3 & 4 System 1
- (47) Ignition System Select Relay - Engines 3 & 4 System 2
- (48) Emergency Ignition Light Dimming Relay
- (49) KW-KVAR Relay - Generators 1 & 2
- (50) KW-KVAR Relay - Generators 3 & 4
- (51) Inboard Fuel Booster Pump Relay - Tank 1
- (52) Inboard Fuel Booster Pump Relay - Tank 2

*Applicable to airplanes CV1 through CV34.

**Applicable to airplanes CV35 and on.

MAINTENANCE MANUAL

- (53) Inboard Fuel Booster Pump Relay - Tank 3
- (54) Inboard Fuel Booster Pump Relay - Tank 4
- (55) Inverter Relay (Ignition System) Engine 1
- (56) Inverter Relay (Ignition System) Engine 2
- (57) Inverter Relay (Ignition System) Engine 3
- (58) Inverter Relay (Ignition System) Engine 4
- (59) Essential DC Bus Light Off Relay
- (60) Emergency DC Bus Light Off Relay
- (61) Instrument Power Transfer Relay
- (62) Outboard Fuel Booster Pump Relay - Tank 1
- (63) Outboard Fuel Booster Pump Relay - Tank 2
- (64) Outboard Fuel Booster Pump Relay - Tank 3
- (65) Outboard Fuel Booster Pump Relay - Tank 4
- (66) Engine Anti-Ice Relay No. 1
- (67) Engine Anti-Ice Relay No. 2
- (68) Engine Anti-Ice Relay No. 3
- (69) Engine Anti-Ice Relay No. 4
- (70) Tie Control Transfer Relay
- (71) Main Instrument Transformer Indicator Relay
- (72) Standby Instrument Transformer Indicator Relay
- (73) *Anti-Shock Body Fuel Transfer Pump Relay No. 4 Outboard
- (73) **Exhaust Gas Temperature Indicator, Fire Detector and Fuel Flow Transfer Relay - Engines 1 & 4
- (74) *Anti-Shock Body Fuel Transfer Pump Relay No. 1 Outboard
- (74) **Exhaust Gas Temperature Indicator, Fire Detector and Fuel Flow Transfer Relay - Engines 2 & 3
- (75) *Gust Lock Relay
- (75) **Anti-Vortex Valve Override Relay
- (76) Angle Attack Heater Power Warning Relay
- (77) ***Forward Cabin Lights Control Relay
- (77) **Blank
- (77) ****Cabin Lights Control Relay
- (78) ***Reverse Thrust Relay No. 1
- (78) *****Blank
- (79) ***Reverse Thrust Relay No. 2
- (79) *****Blank
- (80) *Exhaust Gas Temperature Indicator and Fire Detector Transfer Relay - Engines 1 & 4
- (80) **Cabin Lights Control Relay
- (81) *Exhaust Gas Temperature Indicator and Fire Detector Transfer Relay - Engines 2 & 3
- (81) **Gust Lock Relay
- (82) Automatic In-Flight Nose Landing Gear Brake Relay
- (83) Left-hand Landing Gear Ground Safety Relay No. 5
- (84) Inboard Spoiler Deactivation Relay

*Applicable to airplanes CV26 and on.

**Applicable to airplanes CV1 through CV25.

***Applicable to airplanes CV26 through CV34.

****Applicable to airplanes CV35 and on.

*****Applicable to airplanes CV1 through CV25, CV35 and on.

CONVAIR MODEL 30
MAINTENANCE MANUAL

- (85) Outboard Spoiler Deactivation Relay
- (86) Emergency Lights Latch Relay
- (87) *Anti-Vortex Valve Override Relay
- (87) Blank
- (88) *Fuel Flow Relay - Inverter
- (88) **Anti-Shock Body Fuel Transfer Pump Relay No. 4 Outboard
- (89) *Fuel Flow Relay - Reset
- (89) **Anti-Shock Body Fuel Transfer Pump Relay No. 1 Outboard
- (90) Anti-Shock Body Fuel Warn Relay No. 4 Inboard
- (91) Anti-Shock Body Fuel Warn Relay No. 4 Outboard
- (92) Anti-Shock Body Fuel Warn Relay No. 1 Inboard
- (93) Anti-Shock Body Fuel Warn Relay No. 1 Outboard

*Applicable to airplanes CV26 and on.

**Applicable to airplanes CV1 through CV25.

CONVAIR MODEL 30
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ELECTRICAL POWER - MAINTENANCE PRACTICES

1. Adjustment/Test Procedure for Connecting External AC Power

A. General.

The following procedure will aid the maintenance man when external power is required. This is the basic procedure for connecting external power to the airplane and energizing the load buses individually. (For a detailed procedure for testing the External AC Power System, including warning light sequence and voltage checks, refer to Section 24-3-0, Adjustment/Test.)

B. Equipment Required - External ac power unit.

C. Preparation.

- (1) Check that the external power control switch is in the OFF position.
- (2) Actuate the four bus tie control switches to the OPEN position.
- (3) Connect the main and auxiliary plugs from the external ac power unit to the airplane external power receptacles.
- (4) Turn on the external ac power unit.

D. Test External AC Power System.

- (1) Actuate the external power control switch to the ON position.
- (2) Place the pilots' ac essential bus selector switch in the EXT PWR position.
- (3) Actuate the four T-R control switches to the ON position.
- (4) Actuate the No. 1 bus tie control switch to the CLOSE position.
 - (a) This switch action indirectly connects external ac power to the No. 1 nonessential ac bus if the No. 1 load reduction switch is in the ON position.
 - (b) Actuating either of these switches to the opposite position will disconnect external ac power from the No. 1 nonessential ac bus.
- (5) Actuate the No. 2 bus tie control switch to the CLOSE position.
 - (a) This switch action indirectly connects external ac power to the No. 2 essential ac bus.
 - (b) Moving this switch to the OPEN position will disconnect external ac power from the No. 2 essential ac bus.

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- (6) Actuate the No. 3 bus tie control switch to the CLOSE position.
 - (a) This switch action indirectly connects external ac power to the No. 3 essential ac bus.
 - (b) Moving this switch to the OPEN position will disconnect external ac power from the No. 3 essential ac bus.
- (7) Actuate the No. 4 bus tie control switch to the CLOSE position.
 - (a) This switch action indirectly connects external ac power to the No. 4 nonessential ac bus if the No. 4 load reduction switch is in the ON position.
- (8) Actuate the external power control switch to the OFF position and turn off the external power unit.
- (9) Remove the external main and auxiliary electrical plugs.

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CONSTANT SPEED DRIVE SYSTEM - DESCRIPTION AND OPERATION1. Description

Each constant speed drive system comprises a drive unit, a load controller, a quick-disconnect solenoid circuit, an oil tank, an oil to fuel cooler, and oil lines to route system oil between components. The speed of the ac generators is maintained at a constant rpm by the constant speed drive (CSD) system. The General Electric drive units convert the variable speed of the engine to a constant output speed to drive the generators.

2. Operation

The constant speed drive system operates whenever the engine operates. The CSD unit input shaft operates at engine speeds (0 to 7760 rpm). The output shaft maintains a steady 6000 rpm when input speed is between 4300 and 7600 rpm. Output speed tolerances are plus or minus one percent during steady state operation and plus or minus five percent during transient loading.

As an engine starts, oil from the CSD oil tank is routed into the drive and pressurized by an integral pump. Drive oil is then routed to the various components for operation. The output shaft connects hydraulically to the input shaft. Excess oil from the drive is routed back to the oil tank via the fuel-to-oil cooler. This cooler maintains the oil at proper operating temperatures.

If a malfunction occurs, such as high oil temperature (indicated by the DRIVE MALFUNCT warning light on the flight engineer's ac control panel), the CSD CONT switch should be moved to the DISC position. This switch action applies 28-volt dc power to the quick-disconnect solenoid which disengages the CSD from the accessory drive. The disconnect assembly is reset only on the ground with the engine stopped by manually pulling out the reset knob until the handle release bracket locks in place.

CAUTION: DO NOT ACTUATE THE CSD DISCONNECT WHEN ENGINE SPEED IS LESS THAN 1000 RPM. BEFORE ENGAGING THE CSD DISCONNECT, VISUALLY CHECK THE ENGINE TO SEE THAT IT IS COMPLETELY STOPPED.

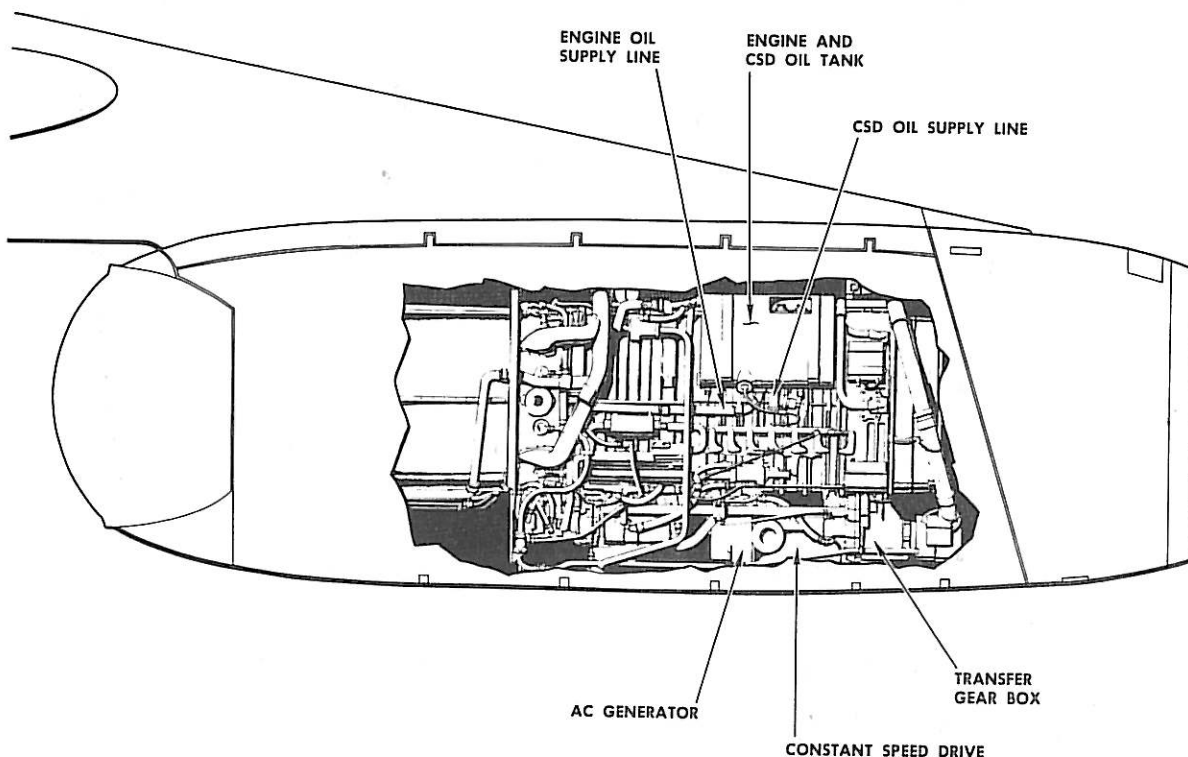
3. Constant Speed Drive (see Figures 1 through 4)

The CSD unit consists of two ball-piston hydraulic elements, control governors, gearing and other mechanical accessories for control and operation. Each CSD unit is driven from the aft side of the forward transfer gear box on each engine. In effect, a CSD unit is a variable input transmission with a constant output speed. The following subparagraphs briefly describe the CSD unit components.

- A. Drive Housing. The drive housing is a machined, magnesium alloy casting which houses and serves as a mounting unit for all components of the drive assembly.

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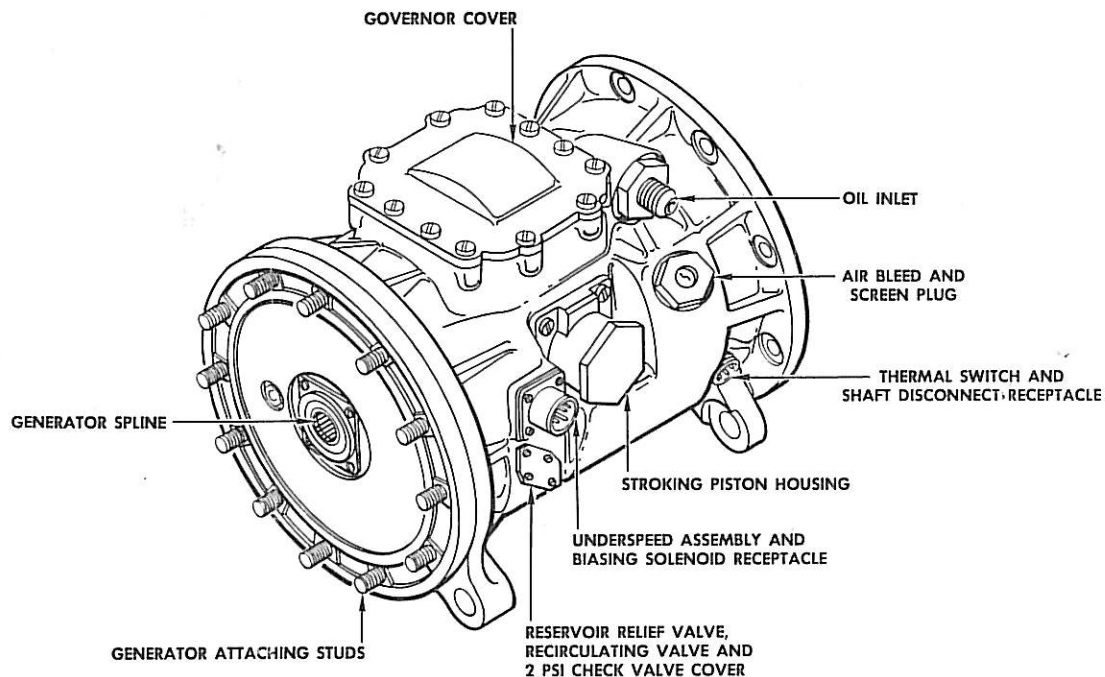
- B. Input Element Hydraulic Assembly. The input element hydraulic assembly consists of a cylinder block and race assembly, a coupling ring and a strokable race.
- C. Output Element Hydraulic Assembly. The output element hydraulic assembly consists of the output cylinder block assembly, a spline coupling and an intermediate shaft. The cylinder block assembly connects to the intermediate shaft through a spline coupling and is supported by and rotates on the inner race of the input element cylinder block assembly.
- D. Pintle Assembly. The pintle assembly (see Figure 5) mounts inside the CSD housing and supports the input and output hydraulic elements.
- E. Supply and Scavenge Pumps. The supply and scavenge pumps share a common housing and are driven by a shaft from the accessory drive gear. Oil for hydraulic pressure and lubrication is supplied by the supply pump. The scavenge pump directs excess oil from the elements and sump oil to the oil return line.
- F. Stroking and Return Pistons. The stroking and return pistons are located 180 degrees apart on opposite sides of the strokable race. The strokable race is positioned for an increase or decrease in output speed by the control oil pressure acting on both sides of the stroking piston. The return piston acts as a reference spring to allow the race to be moved or to return it to the start position when the engine stops.



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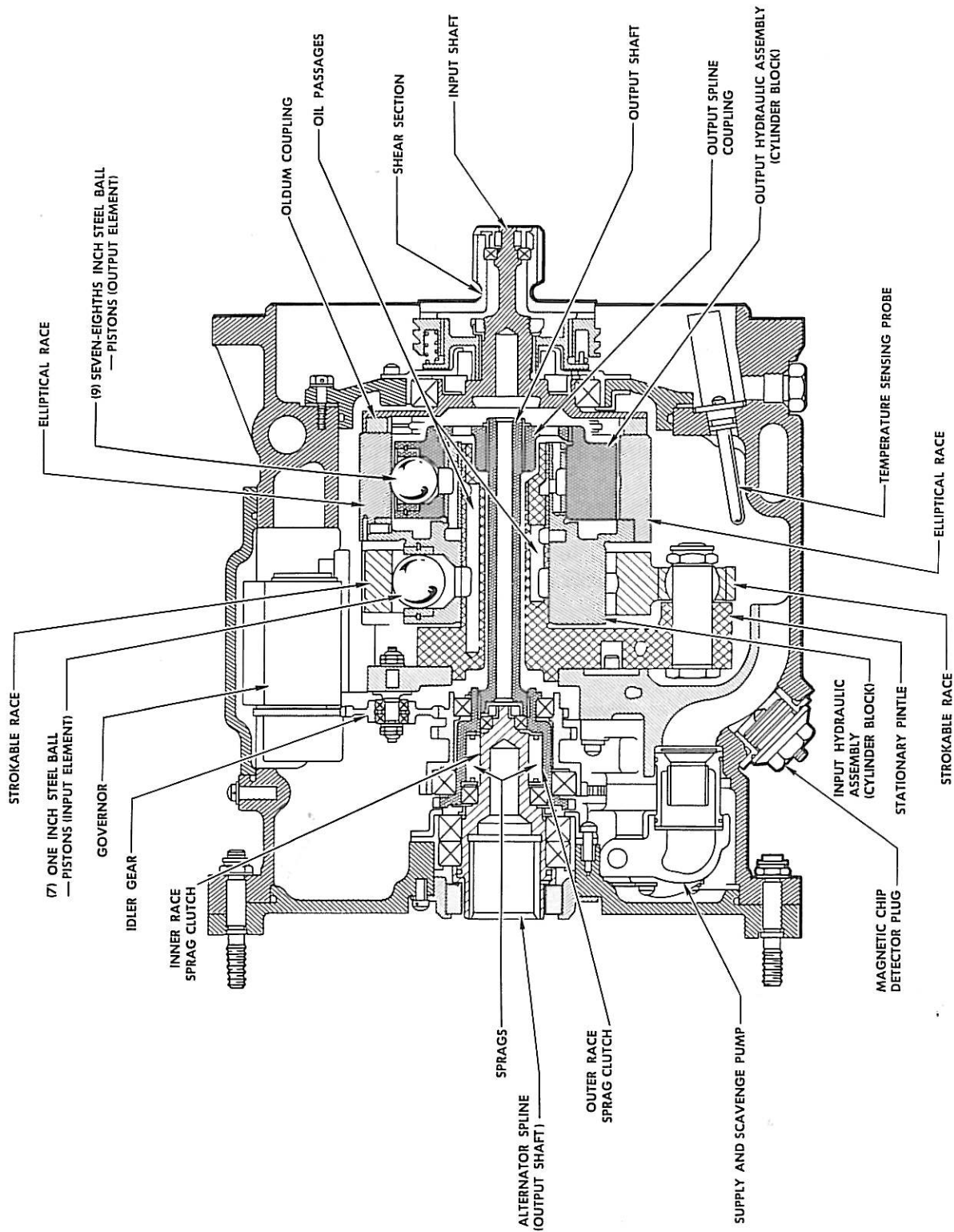
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- G. Control Governor Assembly. The control governor assembly (see Figure 6) comprises a governor flyweight assembly, a reference spring and an overspeed transfer valve. Output drive shaft offspeed is determined by an unbalanced condition existing between the flyweights and the reference spring. An unbalanced condition causes the piston in the control servo valve to move and port high-pressure oil to the increase or decrease side of the stroking piston.
- H. Load Biasing Solenoid. The load biasing solenoid mounts on the actuating lever of the control governor servo valve. It operates with the load controller to provide equal load division when two or more generators are operating in parallel.
- I. Overspeed-Underspeed Control Assembly. The overspeed-underspeed control assembly (see Figure 7) comprises two sets of flyweights enclosed in a single housing. Each set of flyweights balance against an associated reference spring and control the movement of a related shaft.
- J. Drive Reservoir. The drive reservoir is an integral oil supply for the input and output hydraulic elements during sudden transit conditions or on demand.
- K. Quick-Disconnect Assembly. The quick-disconnect assembly (see Figure 8) is an integral part of the input end of the CSD. When a drive malfunction occurs, the quick-disconnect disengages the CSD from the accessory drive.



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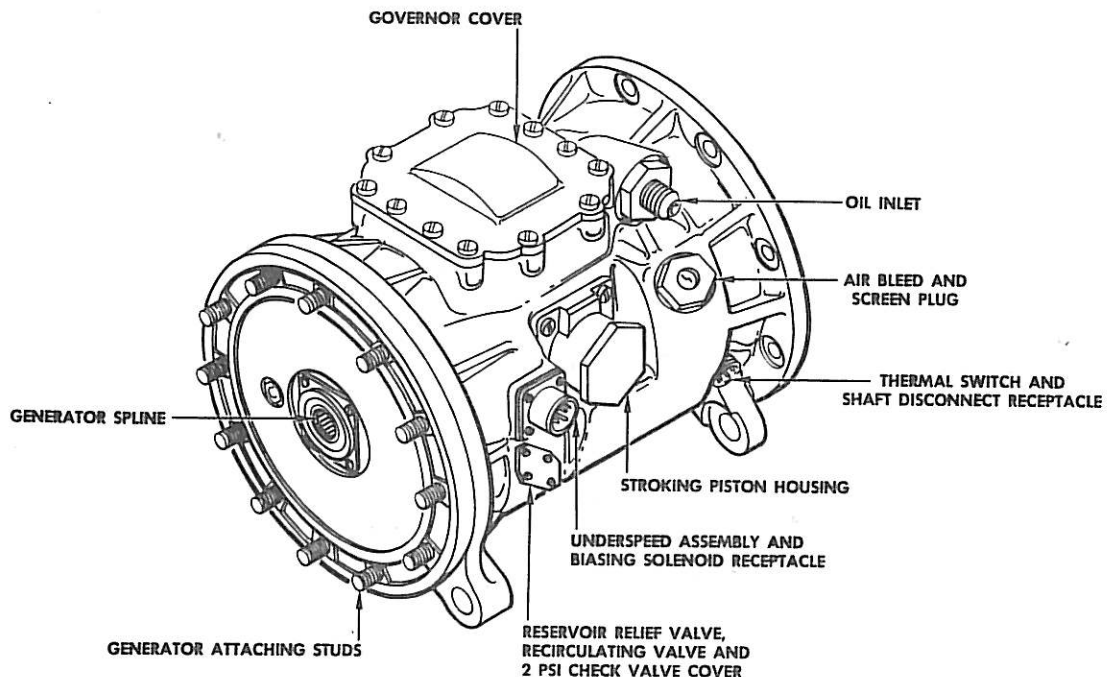
CONVAIR MODEL 30
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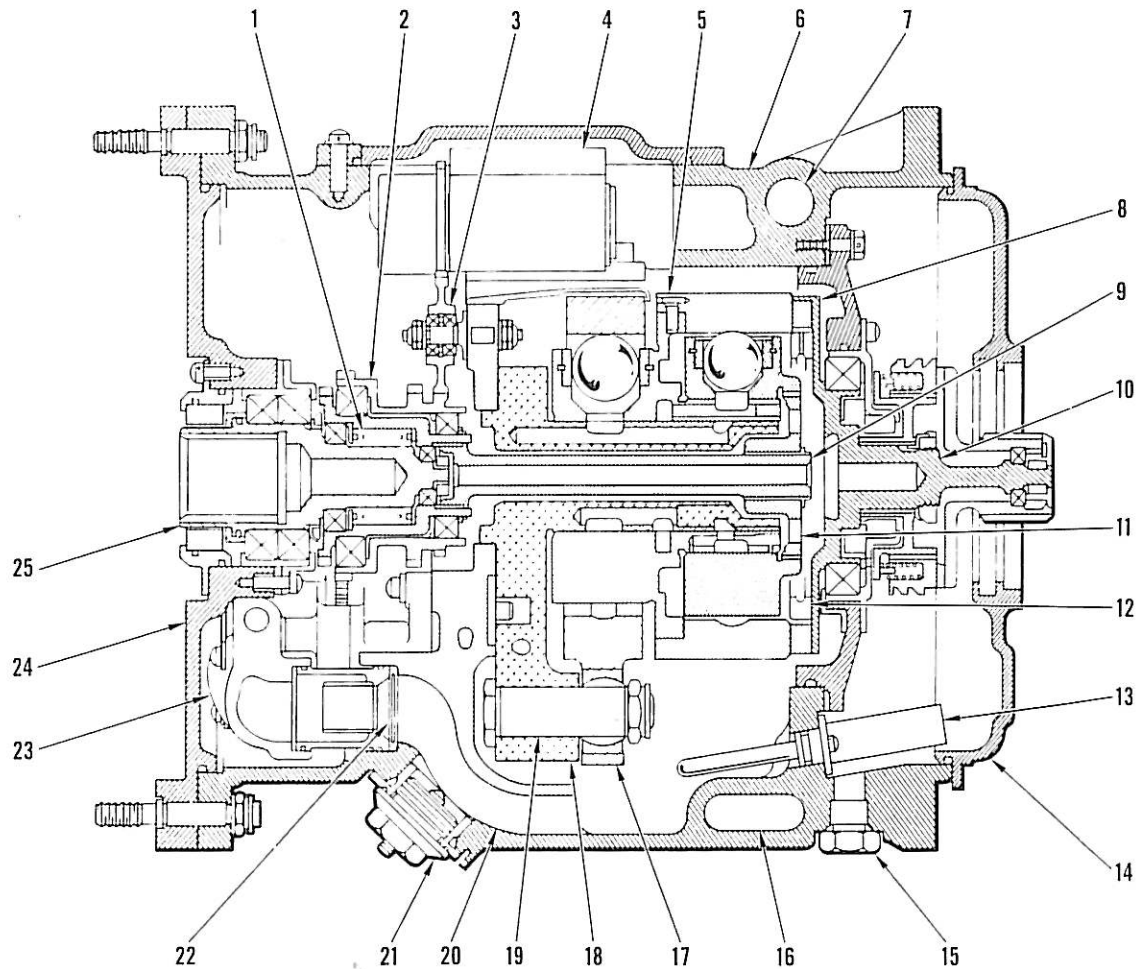
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- G. Control Governor Assembly. The control governor assembly (see Figure 6) comprises a governor flyweight assembly, a reference spring and an overspeed transfer valve. Output drive shaft offspeed is determined by an unbalanced condition existing between the flyweights and the reference spring. An unbalanced condition causes the piston in the control servo valve to move and port high-pressure oil to the increase or decrease side of the stroking piston.
- H. Load Biasing Solenoid. The load biasing solenoid mounts on the actuating lever of the control governor servo valve. It operates with the load controller to provide equal load division when two or more generators are operating in parallel.
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- J. Drive Reservoir. The drive reservoir is an integral oil supply for the input and output hydraulic elements during sudden transit conditions or on demand.
- K. Quick-Disconnect Assembly. The quick-disconnect assembly (see Figure 8) is an integral part of the input end of the CSD. When a drive malfunction occurs, the quick-disconnect disengages the CSD from the accessory drive.



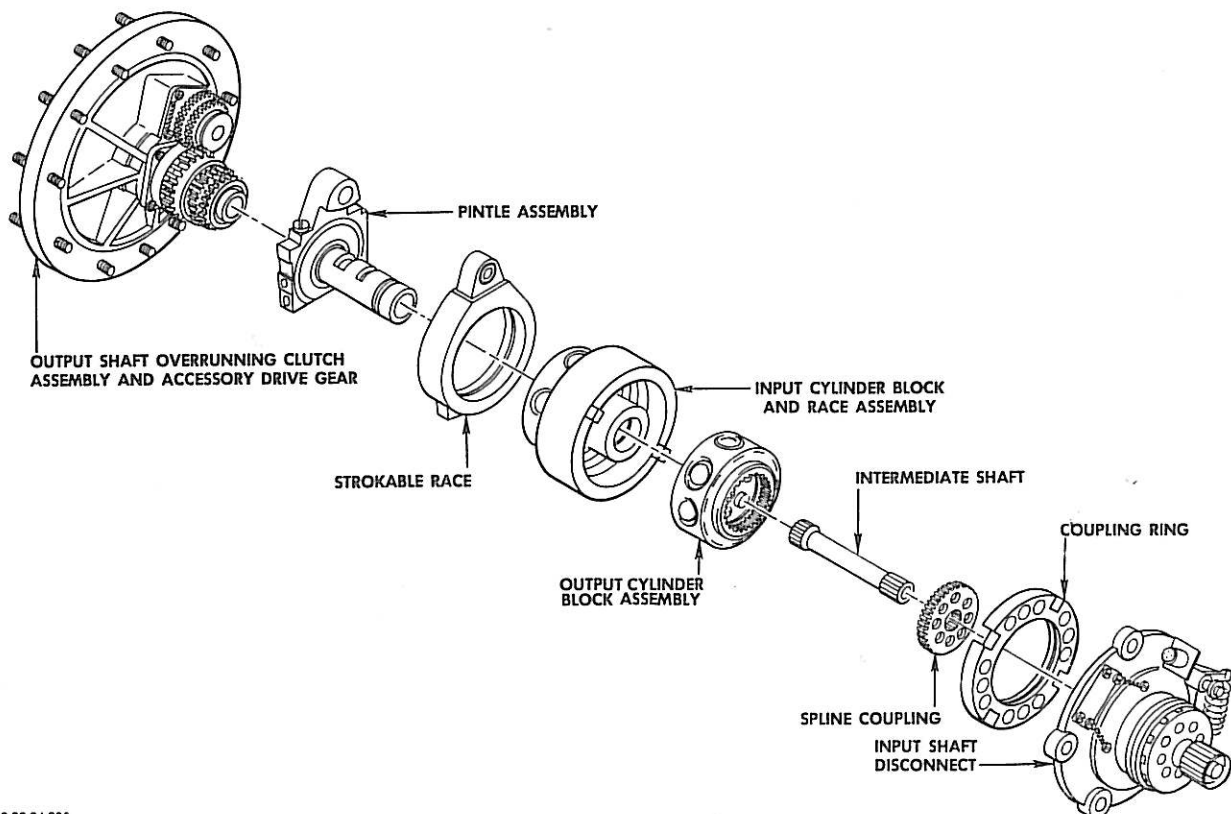
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1. OVERRUNNING CLUTCH ASSEMBLY
2. ACCESSORY DRIVE GEAR
3. GOVERNOR IDLER GEAR
4. CONTROL GOVERNOR
5. INPUT CYLINDER BLOCK ASSEMBLY
6. DRIVE HOUSING
7. OIL INLET PASSAGE
8. OUTPUT CYLINDER BLOCK ASSEMBLY
9. SHAFT DISCONNECT
10. INTERMEDIATE SHAFT
11. SPLINE COUPLING
12. COUPLING RING
13. TEMPERATURE SENSING BULB
14. DIAPHRAGM AND SEAL ASSEMBLY
15. INPUT SHAFT SEAL DRAIN
OR FILL VALVE (IF INSTALLED)
16. RESERVOIR OIL PASSAGE
17. STROKABLE RACE
18. PINTLE ASSEMBLY
19. TRUNNION BOLT
20. SCAVENGE PUMP OIL PICKUP PASSAGE
21. SUMP DRAIN PLUG
22. SCAVENGE PUMP INLET SCREEN
23. SUPPLY AND SCAVENGE PUMP
24. OUTPUT COVER
25. OUTPUT CLUTCH

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- L. **Overrunning Clutch Assembly.** The overrunning clutch assembly is located inside the CSD housing and is an integral part of the output shaft. The clutch assembly is made up of an inner and outer race, separated by bearings. A set of sprags located between the inner and outer race, operate on the wedge principle to protect the drive transmission should a generator attempt to motor it.
- M. **Accessory Gear Drive.** The accessory gear drive is installed over the CSD output shaft and provides the gears for driving the accessories in the CSD. From the gear on the overrunning clutch assembly, a jack gear, consisting of two gears on a common shaft, drives the accessory gear drive. The jack gear is a reduction gear that reduces output speed (6000 rpm) to accessory drive gear speed (4070 rpm).
- N. **Filter Assembly.** An oil filter, mounted on the outer drive housing, removes any dirt or metal particles from the CSD oil (see Figure 9). A bypass valve allows the filter to be bypassed to assure an adequate oil flow to the ball piston units at all times. Two integral check valves allow filter removal for cleaning and maintenance without appreciable oil loss from the drive.



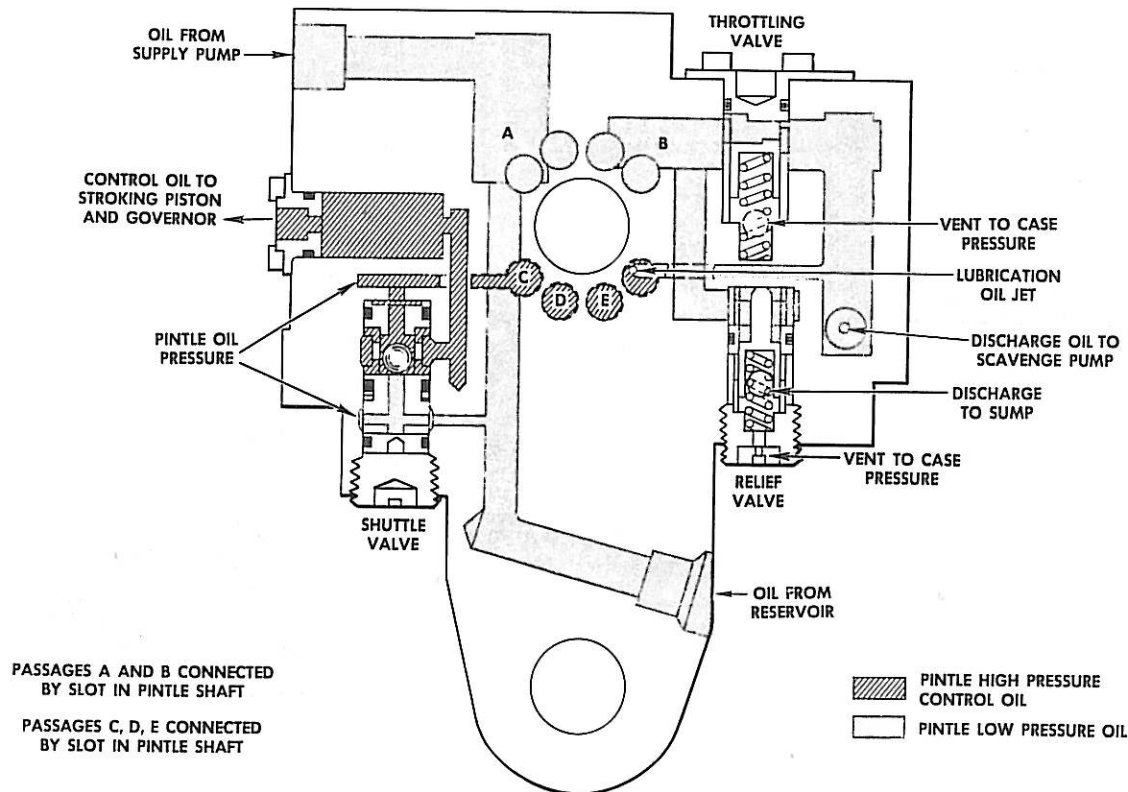
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0. Thermal Switch. A thermal switch senses any overtemperature condition of the CSD sump oil. The unit attaches to the CSD case and the tube that houses the bimetallic switch contacts extends into the sump. The electrical contacts within the switch tube are normally open during CSD system operation. When the sump oil temperature reaches a certain point, thermal expansion of the bimetallic element causes the contacts to close. When the thermal switch contacts close 28-volt dc power routes from the 28-volt dc essential bus through the 2-ampere CSD WARN circuit breaker and then through the switch contacts for illumination of the DRIVE MALFUNCT warning light on the flight engineer's ac control panel.

4. Load Controller (see Figure 10)

The load controller, located in the electrical rack, is a static device electrically connected to each CSD to provide real load division during parallel operation. The unit is approximately seven inches long and four inches wide. An electrical receptacle on the front of the unit provides all electrical connections. During parallel operation of the generator system the load controller (see Figure 11) for each CSD system supplies dc signals to the load biasing solenoid on the control governor assembly so that real load is divided equally among the generators. If one paralleled



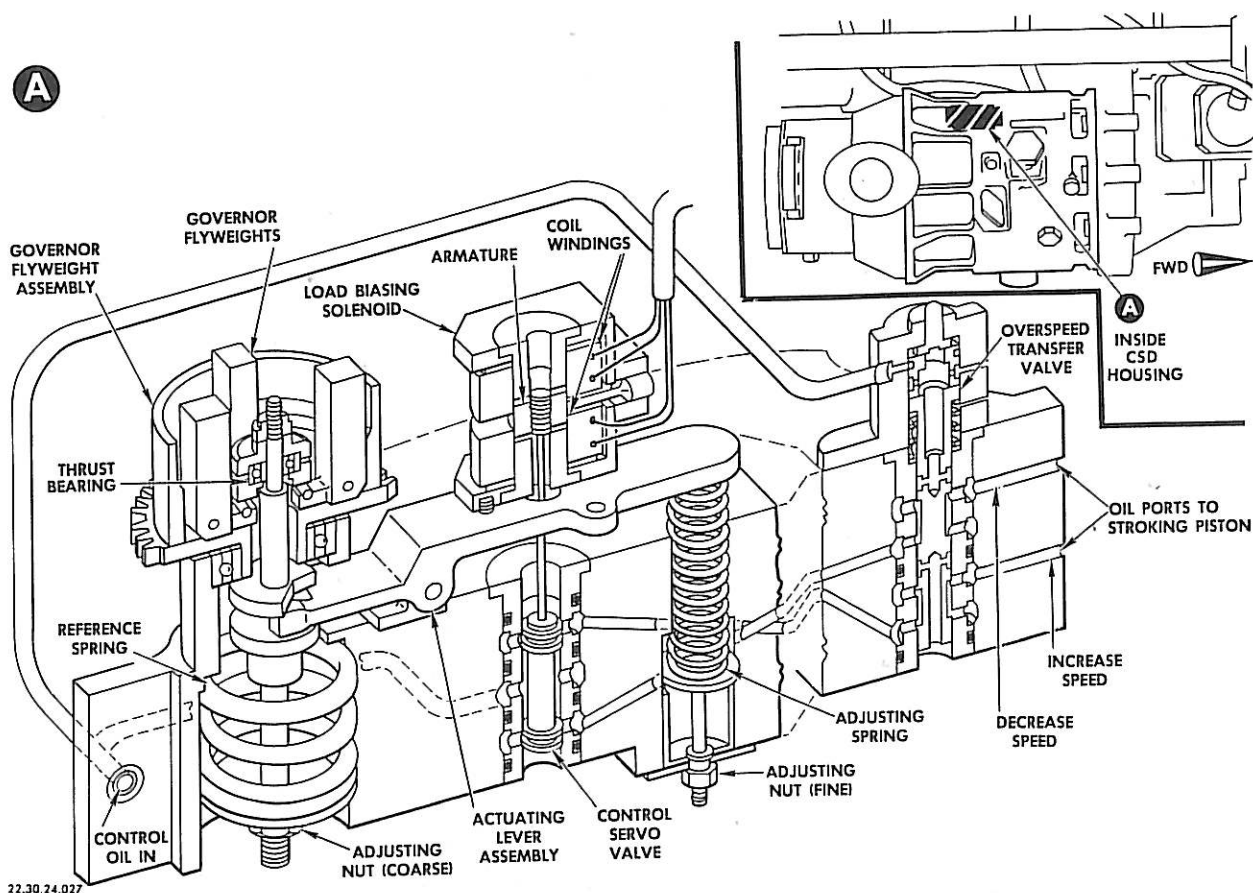
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generator is supporting more than its share of the load, the load controller decreases the torque delivered by the CSD to the generator and proportionally raises the output load-supporting capability of the other CSD units.

The load controllers receive an input signal from the secondary coil of a current transformer located in the power output line of the associated generator. This signal is proportional to the difference between the line current of the associated generator and the average of all other paralleled generators line current. When the input signal enters the controller unit, it is detected for over- or undervoltage, amplified and routed to the load biasing solenoid for operation of the control servo valve in the CSD control governor.

5. CSD Quick-Disconnect Solenoid Circuit (See Figure 12)

The CSD quick-disconnect solenoid circuit connects to the input shaft quick-disconnect assembly to provide a remote electrical means of initiating the disconnect operation. The input shaft disconnect assembly has two positions, a drive position and a disconnect position. These positions are controlled by the disconnect solenoid circuit. During drive operation the solenoid shaft prevents a spring-loaded sector arm from engaging the buttress thread. To allow a disconnect operation, the shaft or core of the



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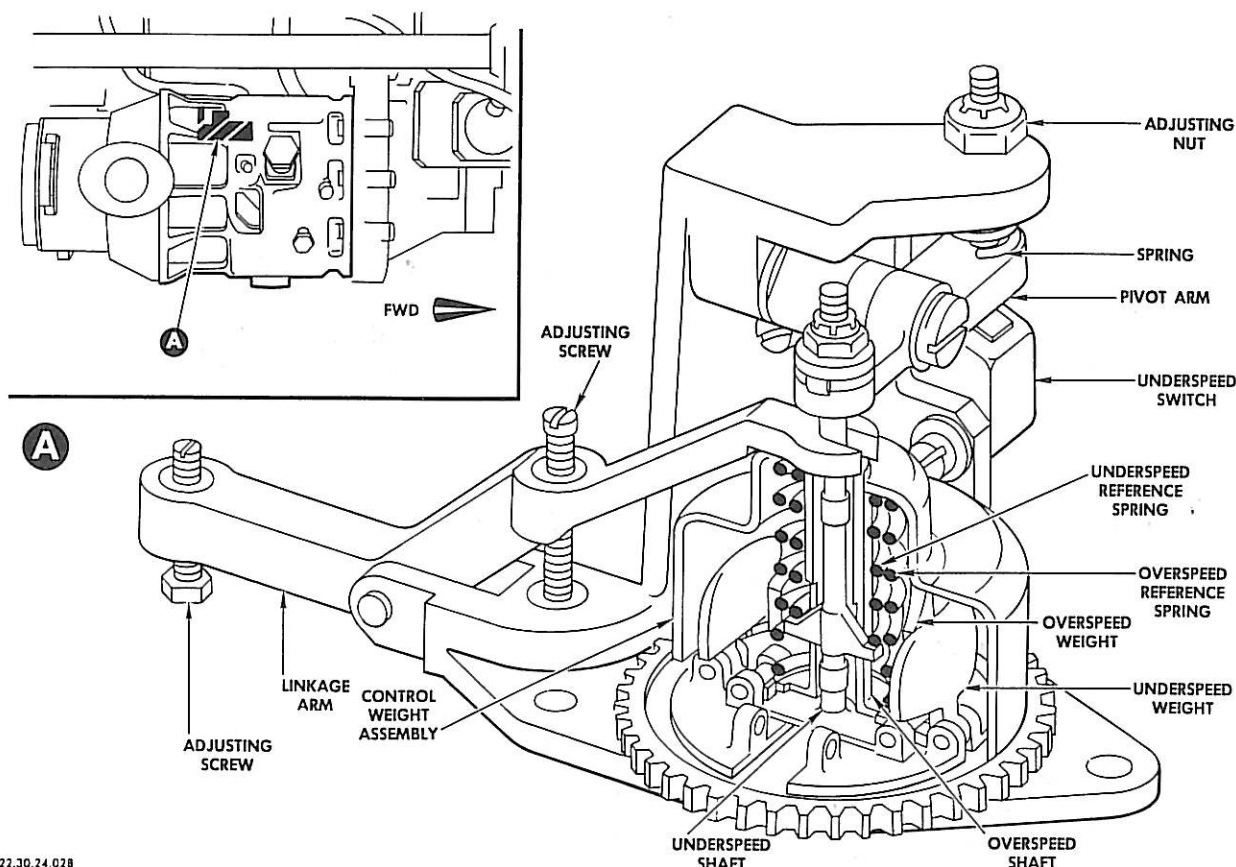
disconnect solenoid must be pulled back to allow the spring-loaded sector arm to engage the buttress thread. The disconnect solenoid circuit consists of the disconnect solenoid and a NORMAL-DISC control switch. Power for the circuit is obtained from the 28-volt dc essential bus through a 10-ampere circuit breaker labeled CSD CONT.

6. CSD Oil System (See Figure 13)

A. Description.

The CSD oil system comprises an oil tank, an oil-to-fuel cooler, and tubing for routing oil. The system provides oil for lubrication, control system hydraulic power and transmission hydraulic power. The oil, Specification MIL-L-7808, is contained in a saddle-type reservoir, mounted on the engine approximately 14 inches above the CSD unit.

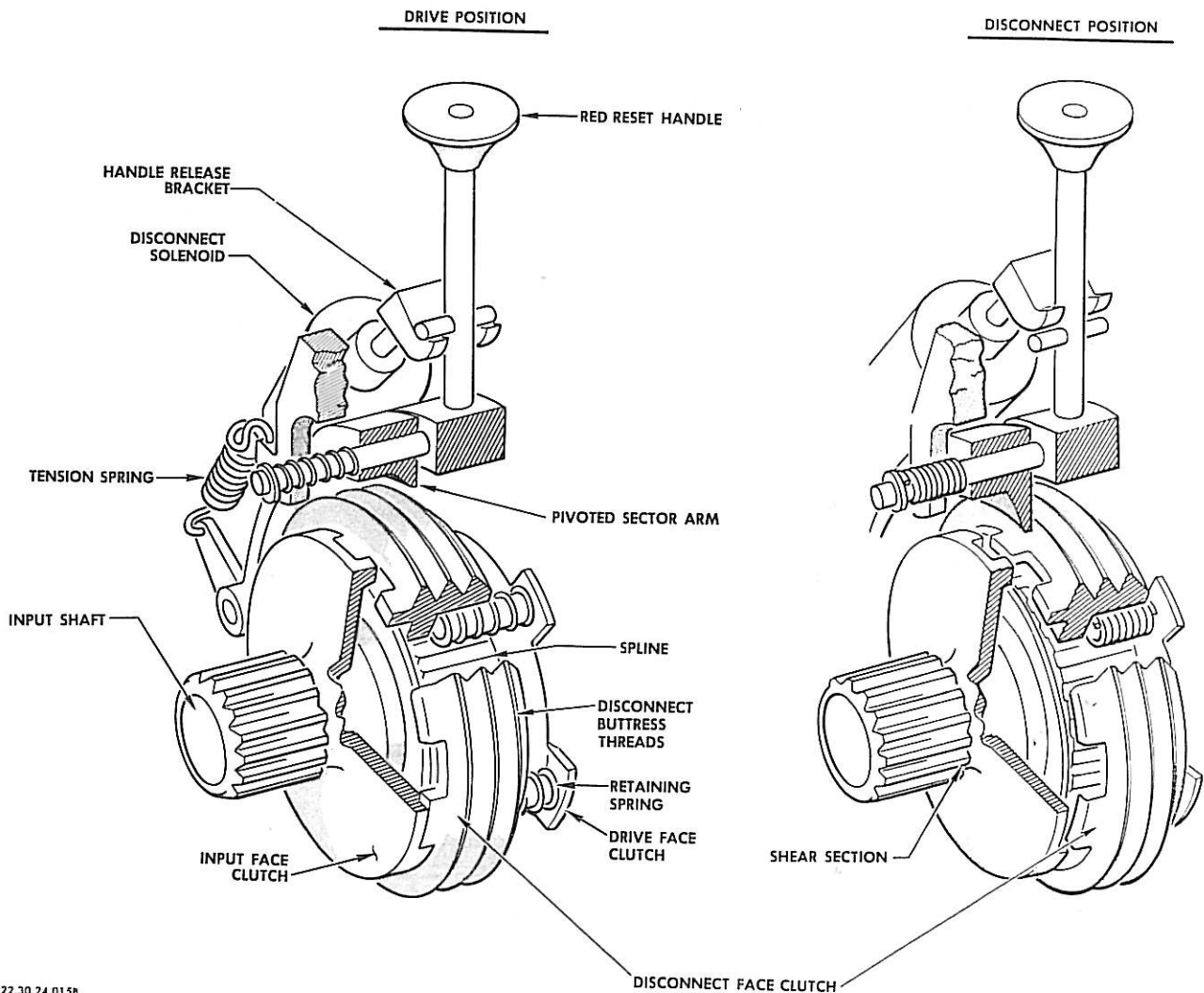
B. The oil from the tank is supplied directly to the inlet on the drive supply sump where it is routed to the supply pump and to a secondary line, through a ball-type shuttle valve, to supply oil for the pintle and governor assembly. This oil supply is used until the drive actually starts rotating and the supply pump develops pressure. When the supply pump pressure rises to a value higher than the pressure developed from the 14-inch head (created by the location of the external oil tank) the



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ball-type shuttle valve closes. The supply pump outlet line routes high-pressure oil through the filter and then to the pintle oil passages, governor, and lubrication jet. Any excess oil ports through a restriction back to the scavenge pump inlet. From the pintle oil passages, the oil is directed to the inlet of the input element. The input element increases the oil pressure and supplies it to the output element, the control valve in the governor ports this high-pressure oil to the increase side of the stroking piston until the drive nears operating rpm. At this time, oil is gradually ported to the decrease side of the stroking piston.



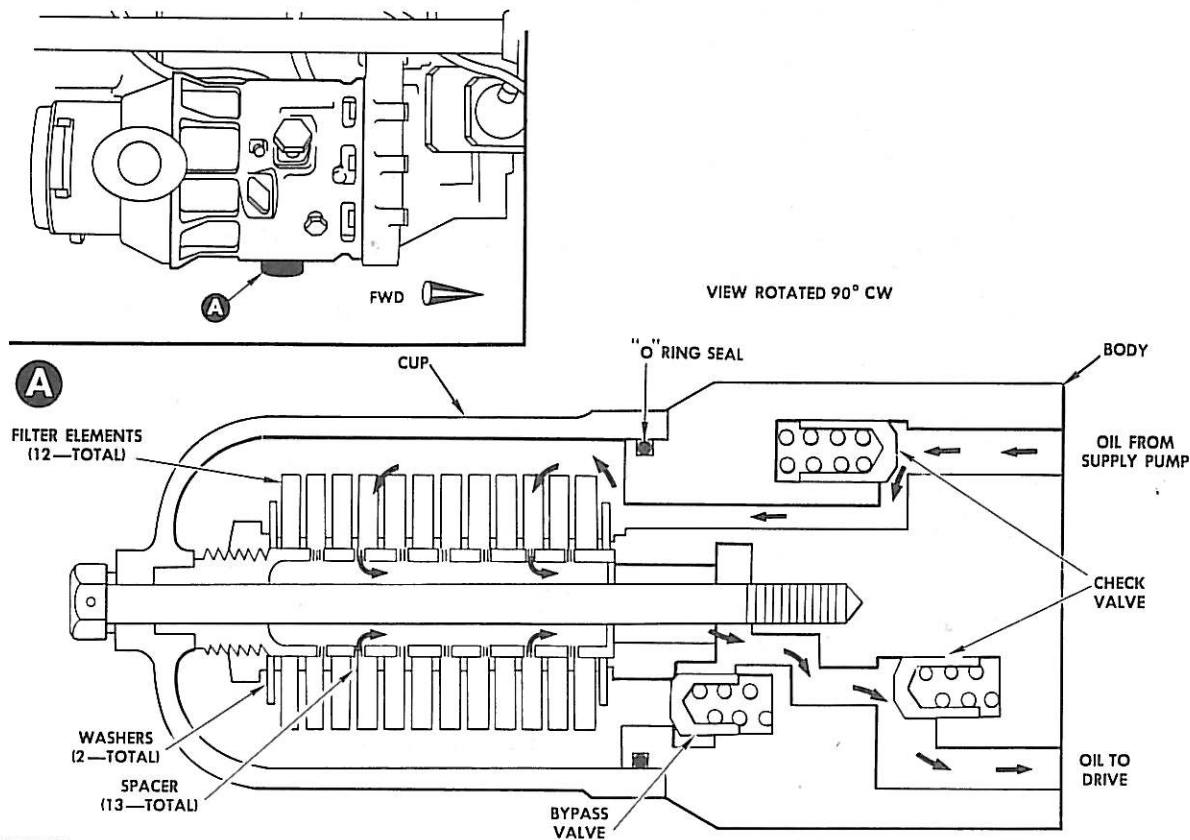
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The excess oil from the elements is directed back to the inlet of the scavenge pump. The scavenge pump also picks up oil from the drive sump and supplies it to the internal drive reservoir. Reservoir oil is maintained under a pressure of from 110 to 120 psig by the throttling valve. As long as this pressure exists, the scavenge pump outlet oil is directed to the return line. Return oil from the internal drive reservoir routes through an oil-to-fuel cooler and then to the oil supply tank for re-circulation.

7. CSD Oil Tank (see Figure 14)

The oil for operation of the CSD system is supplied from an engine-mounted, pressurized tank. A vertical bulkhead within the engine tank divides it into two separate sections, interconnected by an external, pressure-equalizing line. One section supplies the CSD and thrust reverser systems, and the other section supplies engine oil. The CSD section holds approximately 1.7 gallons with an expansion volume of 0.50 gallons.

The CSD oil tank is filled through a gravity feed port located in the recess near the top of the tank. A cap covering the port includes an integral dipstick for measuring oil quantity. Within the port opening is a screen mesh filter that prevents dirt from entering the tank when oil is added. An anti-g baffle is installed to assure a continuous supply of oil under all flight conditions.



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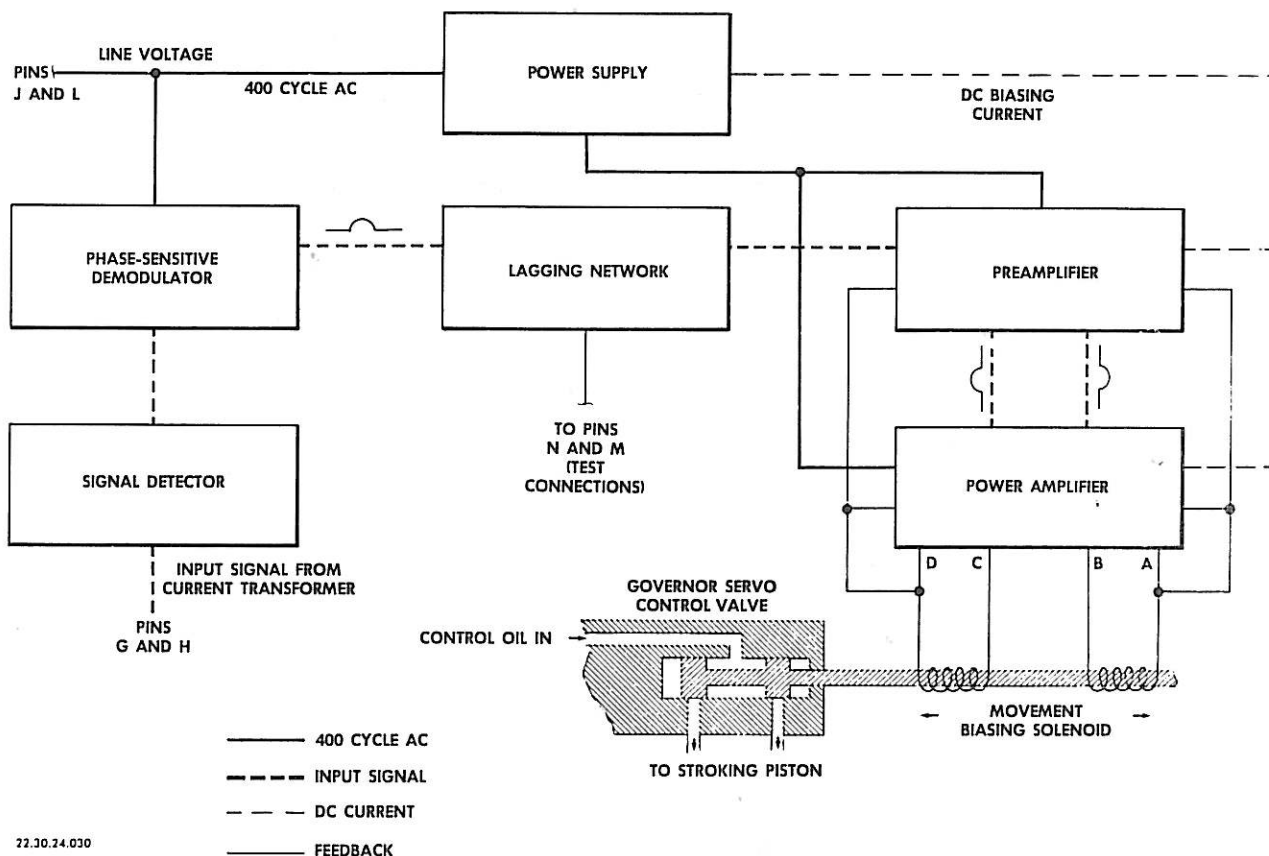
Pressure within the tank is controlled by the tank- and sump-pressurizing valves. The overboard vent of the sump pressurizing valve is full open up to 20,000 feet, and pressure is maintained at a differential of 3 to 4 psig above ambient by the tank-pressurizing valve. At 20,000 feet, the sump-pressurizing valve increases pressure in the system until at 28,000 feet the sump- and tank-pressurizing valves together maintain a differential pressure of from 5 to 7 psig above ambient.

8. Oil-To-Fuel Cooler (see Figure 15)

The oil-to-fuel cooler is a liquid-to-liquid heat exchanger which cools the CSD scavenge oil. Engine fuel is the coolant. The cooler comprises a fuel temperature sensor, an oil shutoff valve, an oil bypass valve, a fuel bypass valve, and cooler tubes.

The fuel temperature sensor operates in conjunction with the oil shutoff valve. When the fuel temperature reaches 117 degrees C (241 degrees F), the thermostatic element of the sensor expands, tending to close the oil shutoff valve.

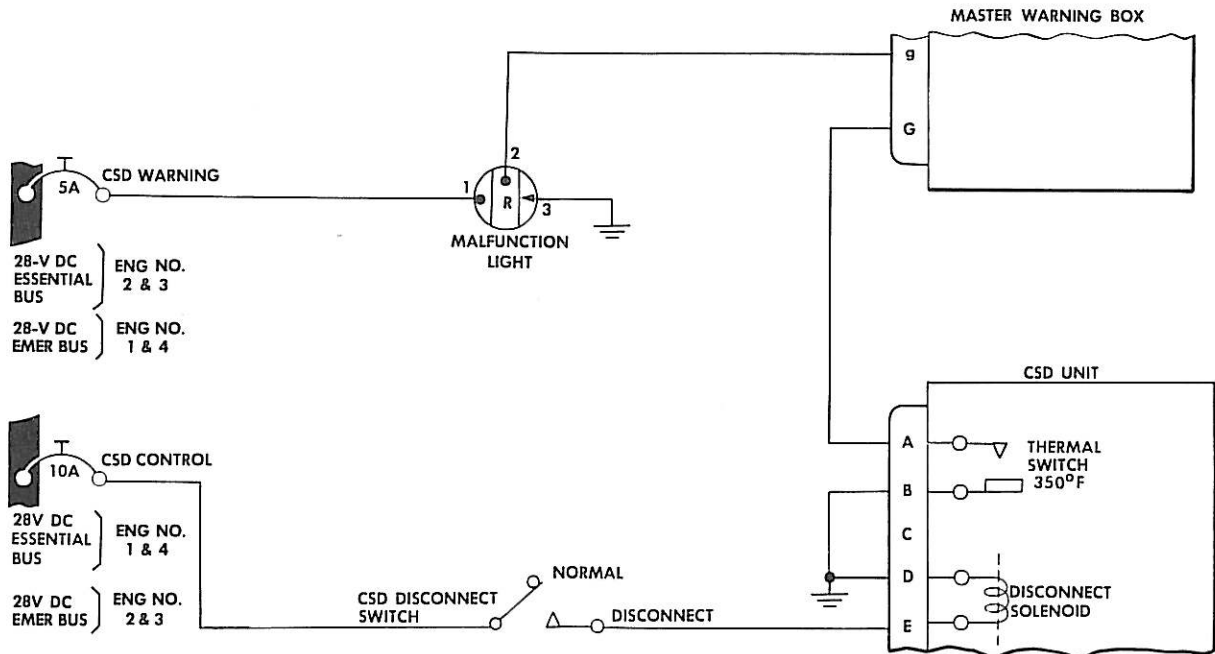
The resulting increased pressure differential across the oil portion of the cooler opens the oil bypass valve; oil flows through the bypass port and the oil outlet. Enough oil is bypassed to prevent the discharge fuel temperature from exceeding 127 degrees C (260 degrees F). Refer to Chapter 72, ENGINE.





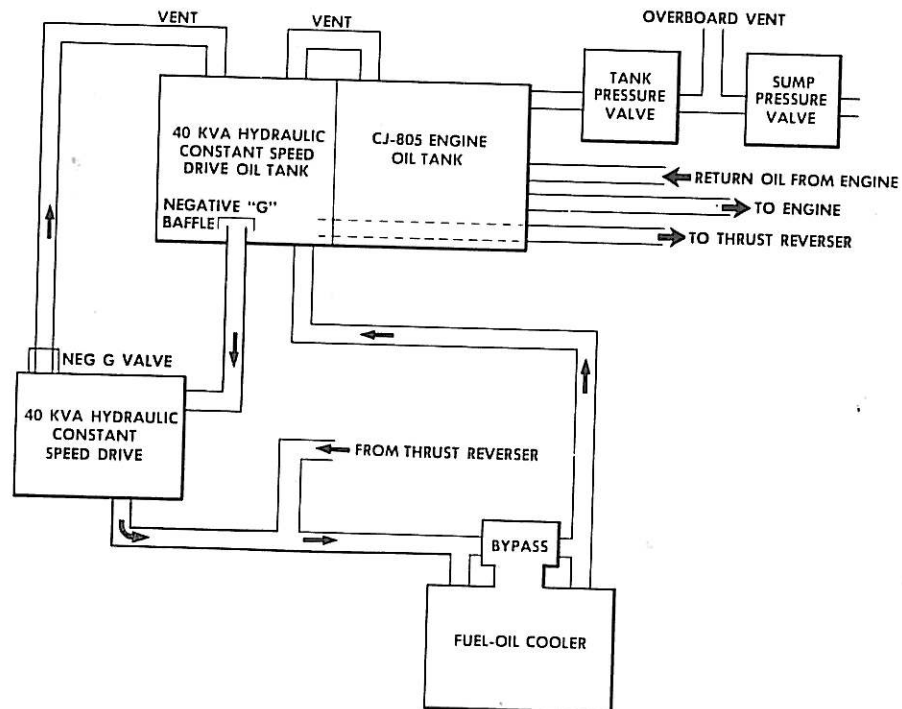
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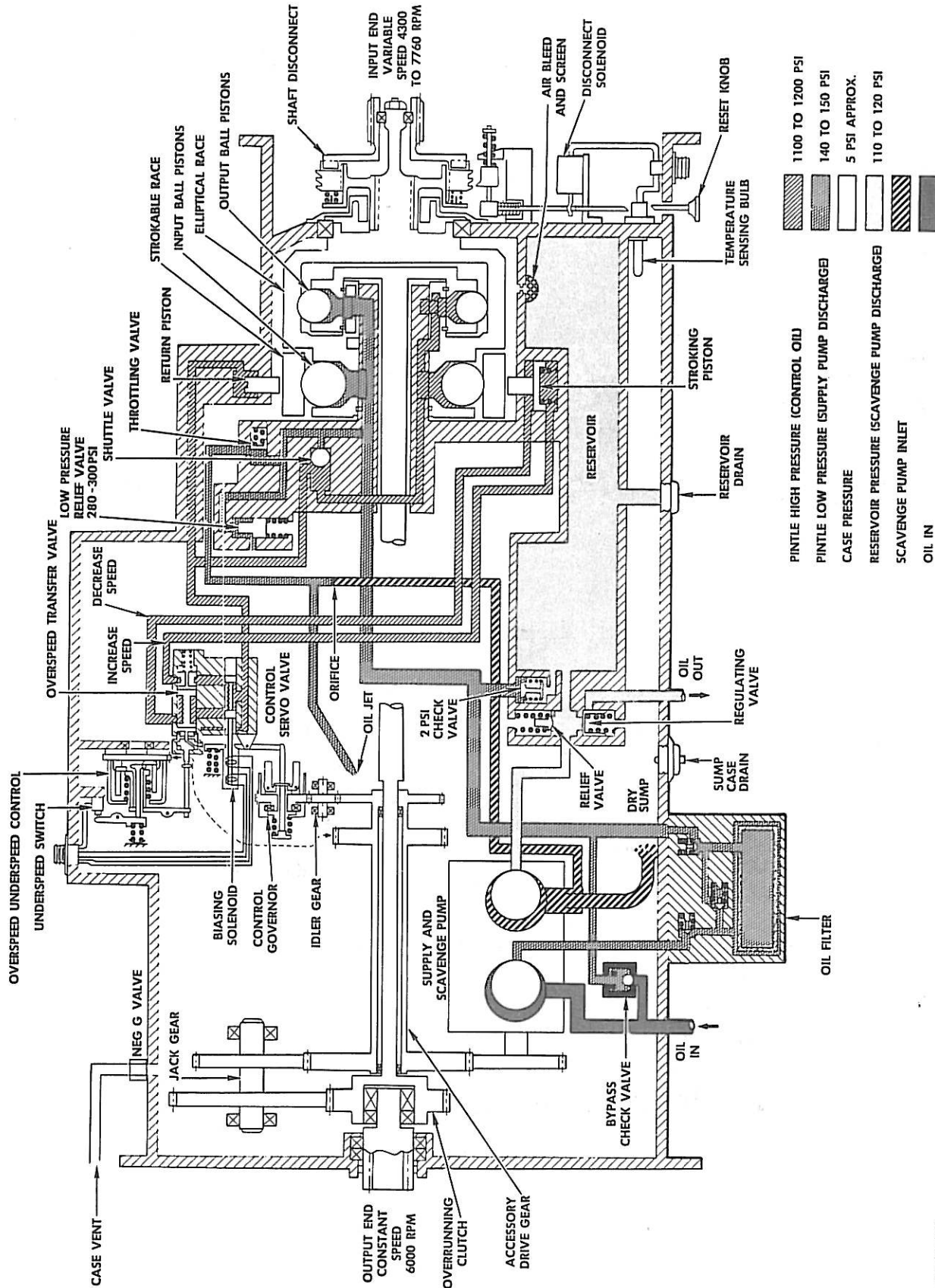
CSD Warning Schematic
Figure 12



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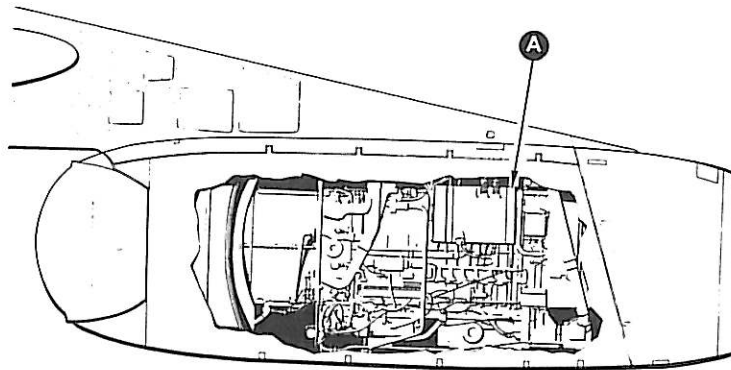
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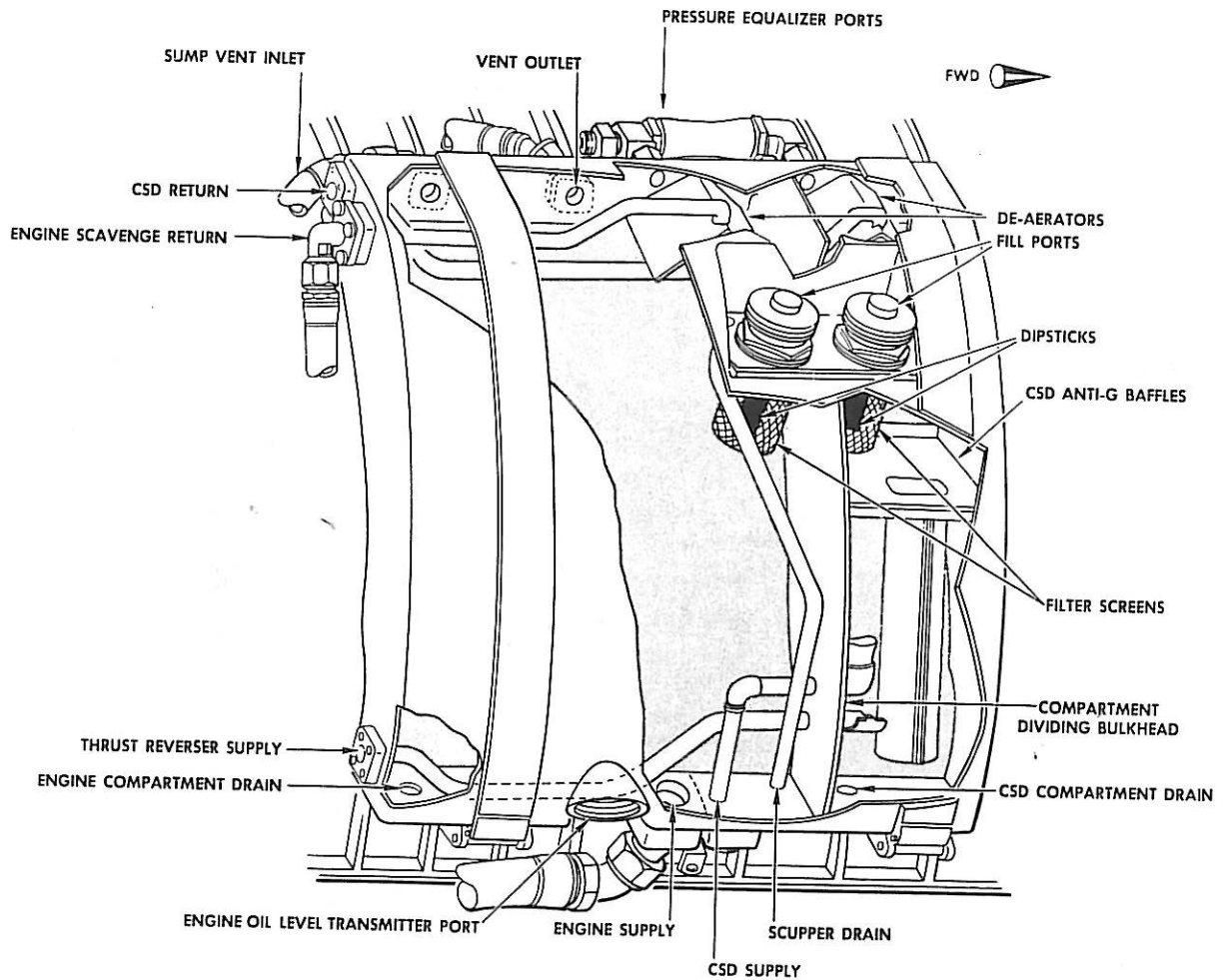


CSD Oil System
Figure 13 (Sheet 2 of 2)

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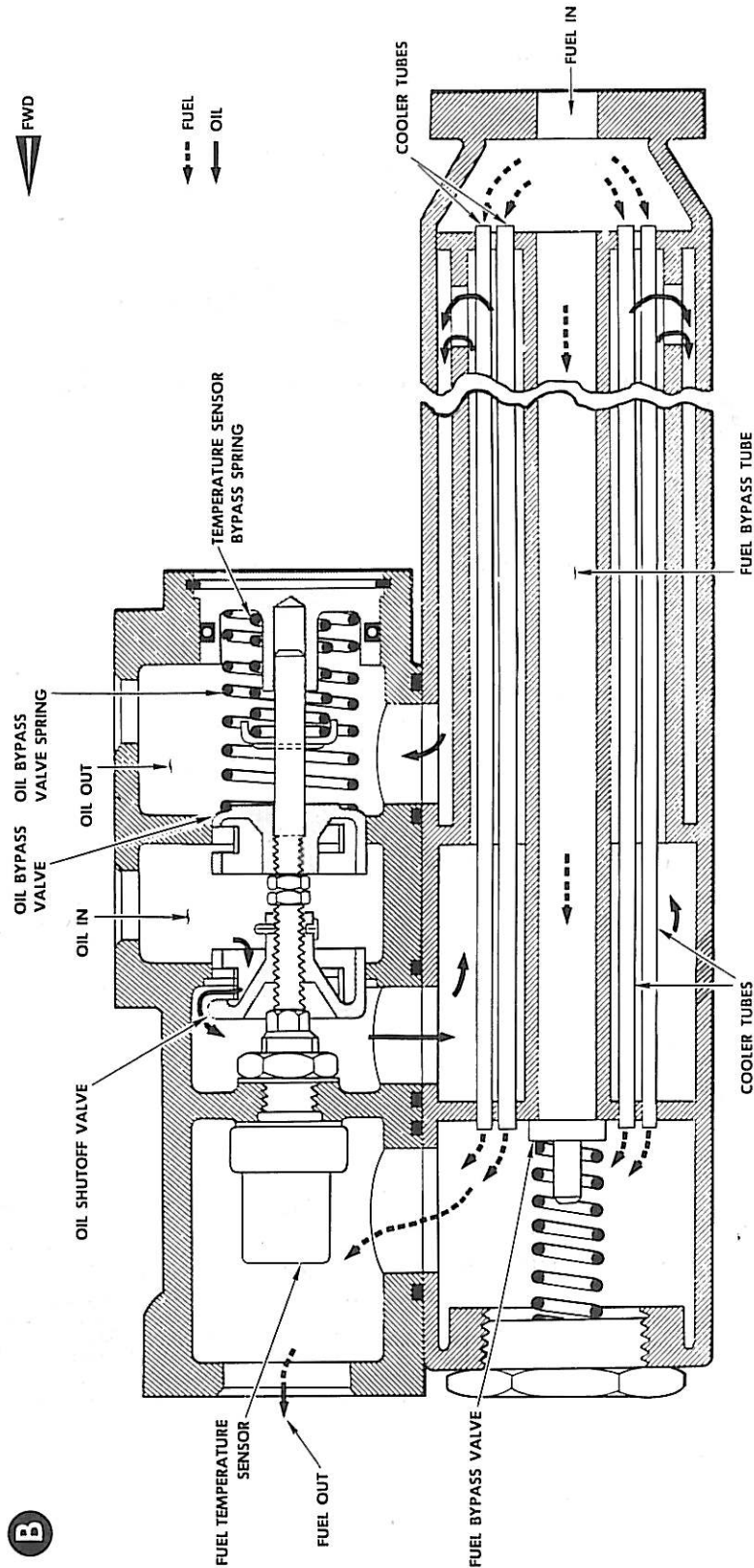
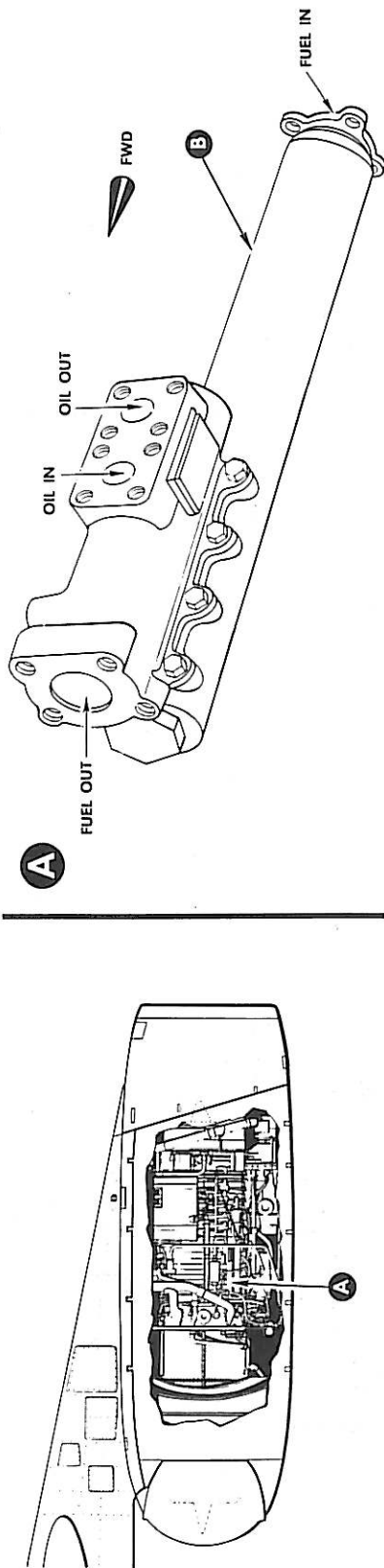


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CSD Oil Supply Tank
Figure 14

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CONSTANT SPEED DRIVE SYSTEM - MAINTENANCE PRACTICES

1. Adjustment/Test Constant Speed Drive System

A. General.

The constant speed drive system requires no external adjustments. Testing the system consists of operating each engine and its associated generator system. Indications of trouble in the CSD system are usually obtained from the ac system indicators; i.e., ammeters, KW/KVAR meters, voltmeters, and frequency meter. (Refer to Section 24-2-0, Adjustment/Test.)

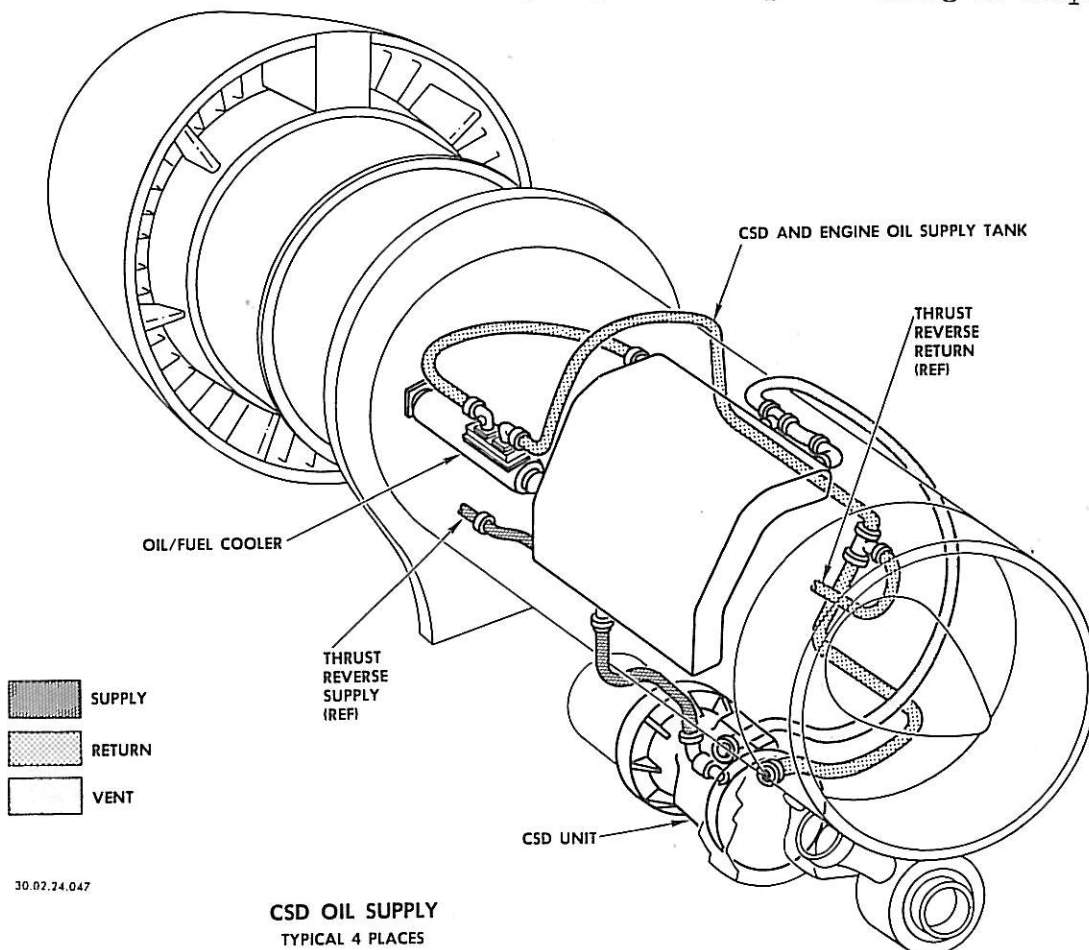
B. CSD Oil System Leak Test (See Figure 201).

(1) Equipment Required - None.

(2) Check CSD Oil System for Leaks.

(a) Turn engine over with ignition OFF and make a complete check of all components and tube fittings in CSD and thrust reverser oil systems.

(b) If leaks are detected, tighten or replace tubing or components.



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- (c) Check oil quantity in tank and service (refer to Chapter 12, SERVICING).
- (d) For procedure on checking thrust reverser oil system (refer to Chapter 78, EXHAUST).

2. Inspection/Check Constant Speed Drive System

A. General.

The following table reflects various inspections to be made and the time interval between checks. Refer to Chapter 12, SERVICING for procedures.

<u>INSPECTION</u>	<u>TIME INTERVAL</u>
Check oil level in drive oil tank.	After each flight
Change oil in drive oil tank.	200 to 300 Hours
Service disconnect cavity.	20 to 35 Hours
Check continuity at chip detector plug.	50 to 70 Hours
Replace oil filter.	50 to 70 Hours
Check fitting and hose connections for oil leaks and tubing for kinks.	50 to 70 Hours
Check input and output shaft seals for excessive oil leaks (more than 5 CC per/hour).	20 to 35 Hours
Check operation of shaft disconnect.	200 to 300 Hours

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CSD UNIT - TROUBLE SHOOTING

<u>POSSIBLE CAUSE</u>	<u>ISOLATION PROCEDURE AND CORRECTION</u>
1. <u>EXCESSIVE LEAKAGE FROM DRIVE SEAL DRAINS ON INPUT AND OUTPUT ENDS (TOTAL OF 5CC/HOUR ALLOWABLE)</u>	
A. Defective packing seal or shaft oil seal on output end.	Check output end shaft and packing seals. If defective, replace drive.
B. Defective packing seal on input end or shaft oil seal of shaft disconnect.	Check input end shaft oil and disconnect seal. If defective replace drive.
2. <u>EXTERNAL OIL LEAKS (i.e. MAGNETIC PLUG OR OIL PLUGS)</u>	
A. Defect packing seals.	Check plugs for oil leakage. If defective replace packing seals.
3. <u>SUDDEN LOSS OF LOAD OR UNABLE TO PICKUP LOAD (INPUT SPEED ABOVE 4475 RPM)</u>	
A. Electrical system.	Check continuity of wiring between drive and connecting components in electrical system. If no continuity, repair or replace wiring.
4. <u>OUTPUT SHAFT FAILS TO ROTATE</u>	
A. No oil in drive.	Determine serviceability of drive and fill oil tank. (Refer to Chapter 12, SERVICING.)
B. Shaft disconnect assembly in disconnect position.	Check position of reset knob. If in the disconnect position, reset knob by pulling it all the way out.
C. Faulty shaft disconnect.	Check shaft disconnect mechanism and disconnect solenoid circuit. If mechanism is faulty replace drive. If incorrect continuity is obtained in solenoid disconnect circuit, repair or replace wiring.
D. Sheared input shaft.	Check drive shear point. If sheared replace drive.
5. <u>INPUT SPEED WITHIN RANGE, LOAD DROPS OFF AND DRIVE GOES INTO UNDERDRIVE</u>	
A. Faulty drive unit.	Recheck operation. If same condition exists, replace drive.

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POSSIBLE CAUSEISOLATION PROCEDURE AND CORRECTION6. DRIVE CASE FLOODED WITH OIL (DURING SINGLE UNIT OPERATION)

A. Faulty drive unit.

Check to see if drive case is flooded with oil. Drain oil from drive case and check operation. If condition repeats, replace drive.

7. HIGH FREQUENCY FLUCTUATION (MORE THAN 4 CPS)

A. Air entrainment (usually on new installation).

Vary drive input speed over entire range and recheck operation. If condition reoccurs replace drive.

8. OUTPUT SPEED ABOVE 404 CPS OR BELOW 396 CPS IN SINGLE UNIT OPERATION

A. Faulty governor.

Disconnect load controller. If frequency is still out of limits, replace drive; if frequency is within limits, proceed to following step.

B. Faulty load controller.

Frequency within limits with load controller disconnected. Make a resistance check between terminals A and B and between C and D of airplane connector to drive. Resistance should check between 400 to 700 ohms. If this measurement is incorrect, replace load controller.

C. Faulty biasing solenoid.

If resistance check in Step B is correct then check resistance between terminals A and B and C and D of drive receptacle. Resistance should check between 400 to 700 ohms. If this measurement is incorrect, replace drive.

D. Aircraft electrical connections

If resistance check in step C is correct, check airplane electrical wiring between drive and load controller. If no continuity, replace or repair wiring.

9. OUTPUT SPEED ABOVE 404 CPS OR BELOW 396 CPS WHEN OPERATING IN PARALLEL

NOTE: Operate in single unit operation to isolate trouble. (Refer to remedies listed in previous steps.)

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POSSIBLE CAUSEISOLATION PROCEDURE AND CORRECTION9. OUTPUT SPEED ABOVE 404 CPS OR BELOW 396 CPS WHEN OPERATING IN PARALLEL (CONT)

A. Electrical system.

Check continuity of electrical system between drive and connecting electrical components. If no continuity repair or replace wiring.

10. TRIP-OUTS AT NORMAL FREQUENCY

A. Faulty drive.

Recheck system operation. If same condition occurs, replace drive.

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CONSTANT SPEED DRIVE - MAINTENANCE PRACTICES1. Removal/Installation Constant Speed Drive (see Figure 201)

A. General.

The following removal/installation procedure is applicable to all CSD units. When a unit requires replacement the generator should be removed first to lessen the handling weight (refer to Section 24-2-1, Removal/Installation).

B. Equipment Required.

- (1) Stand or cart capable of handling approximately 144 pounds (combined weight of CSD and generator).
- (2) A clean 3-gallon container for draining CSD system oil.

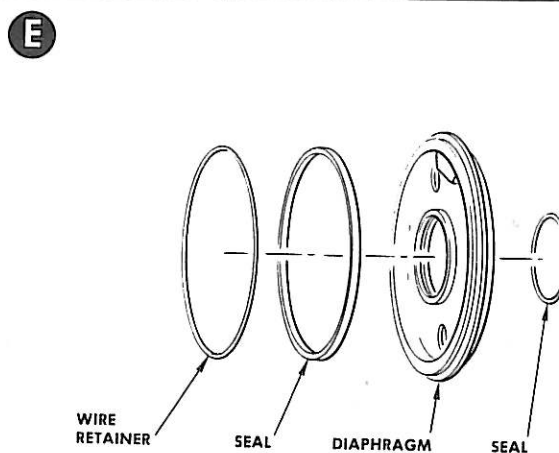
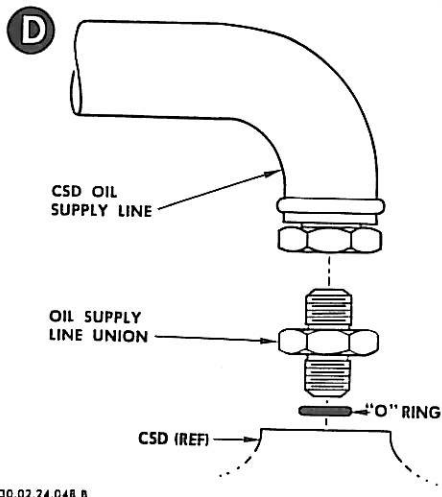
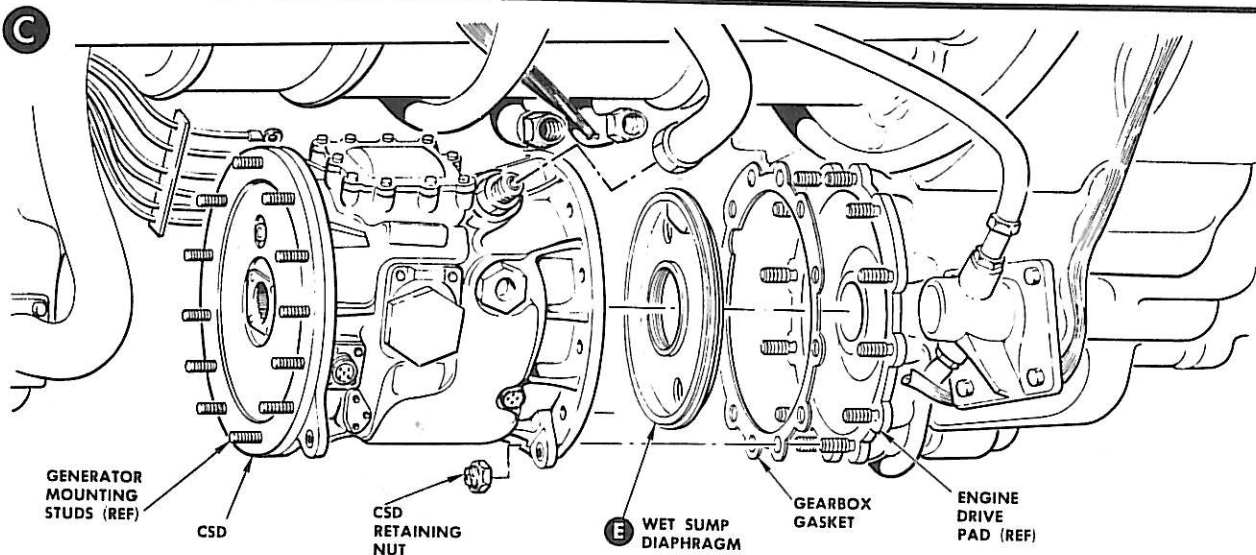
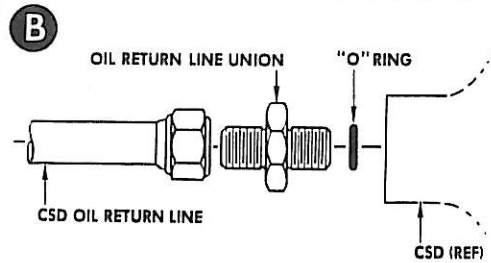
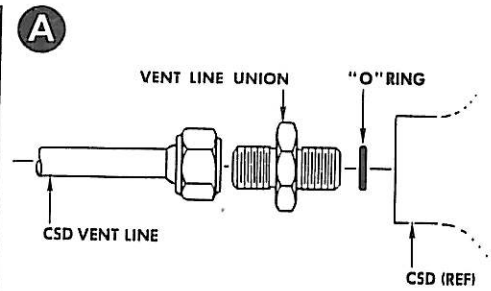
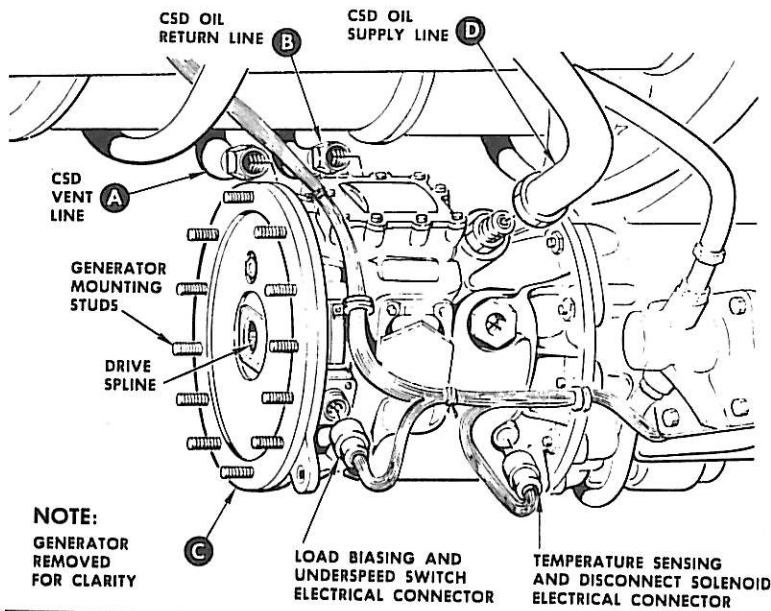
C. Remove Constant Speed Drive.

- (1) Drain oil from tank, CSD unit and the disconnect drive spline cavity. (Refer to Chapter 12, SERVICING.)
- (2) Disconnect and cap the following tubing connections and tag lines for installation:
 - (a) CSD case vent line.
 - (b) CSD oil supply line.
 - (c) CSD oil return line.
- (3) Remove the following electrical connectors and tag for installation:
 - (a) CSD load biasing solenoid and underspeed switch electrical connector.
 - (b) CSD oil thermal switch and disconnect solenoid electrical connector.
- (4) Remove nuts and washers securing CSD unit to transfer gearbox mounting pad; bag and tag for installation.
- (5) Carefully move drive unit axially away from the transfer gearbox pad to disengage the two splines and lower drive from engine.

CAUTION: BE CAREFUL NOT TO DAMAGE THE DRIVE INPUT SPLINE OR HOUSING RABBIT.
- (6) Remove and discard O rings.

NOTE: Install protective caps and plugs in all oil connections openings.

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(7) Remove diaphragm assembly and gasket from transfer gearbox pad.

D. Install Constant Speed Drive.

(1) Install diaphragm assembly on transfer gearbox pad with indexing tab of diaphragm is in gear box pad recess - located at the 9 o'clock position when facing the pad.

(2) Check to ensure diaphragm seats firmly against pad.

NOTE: If diaphragm assembly can be rocked, check the three lugs on opposite side to ensure they are not striking the lockwire around gearbox pad output shaft. If necessary, reposition lockwire to prevent interference with the three diaphragm lugs.

(3) Install gasket to transfer gearbox pad.

(4) Insert new O rings and install all tube fittings removed from replaced drive unit.

(5) Brush a light coat of MIL-L-7808 oil on drive splines.

(6) Pull drive reset knob to ensure the shaft disconnect reset shaft is engaged.

(7) Lift CSD unit in position, engage the two splines and carefully move drive axially against transfer gearbox pad. Install washers and nuts, then tighten to a torque value of 180 to 210 inch-pounds.

(8) Replace the following electrical connectors.

(a) CSD oil thermal switch and disconnect solenoid electrical connectors.

(b) CSD load biasing solenoid and underspeed switch electrical connector.

(9) Replace the following tubing connections:

(a) CSD oil return line.

(b) CSD oil supply line.

(c) CSD case vent line.

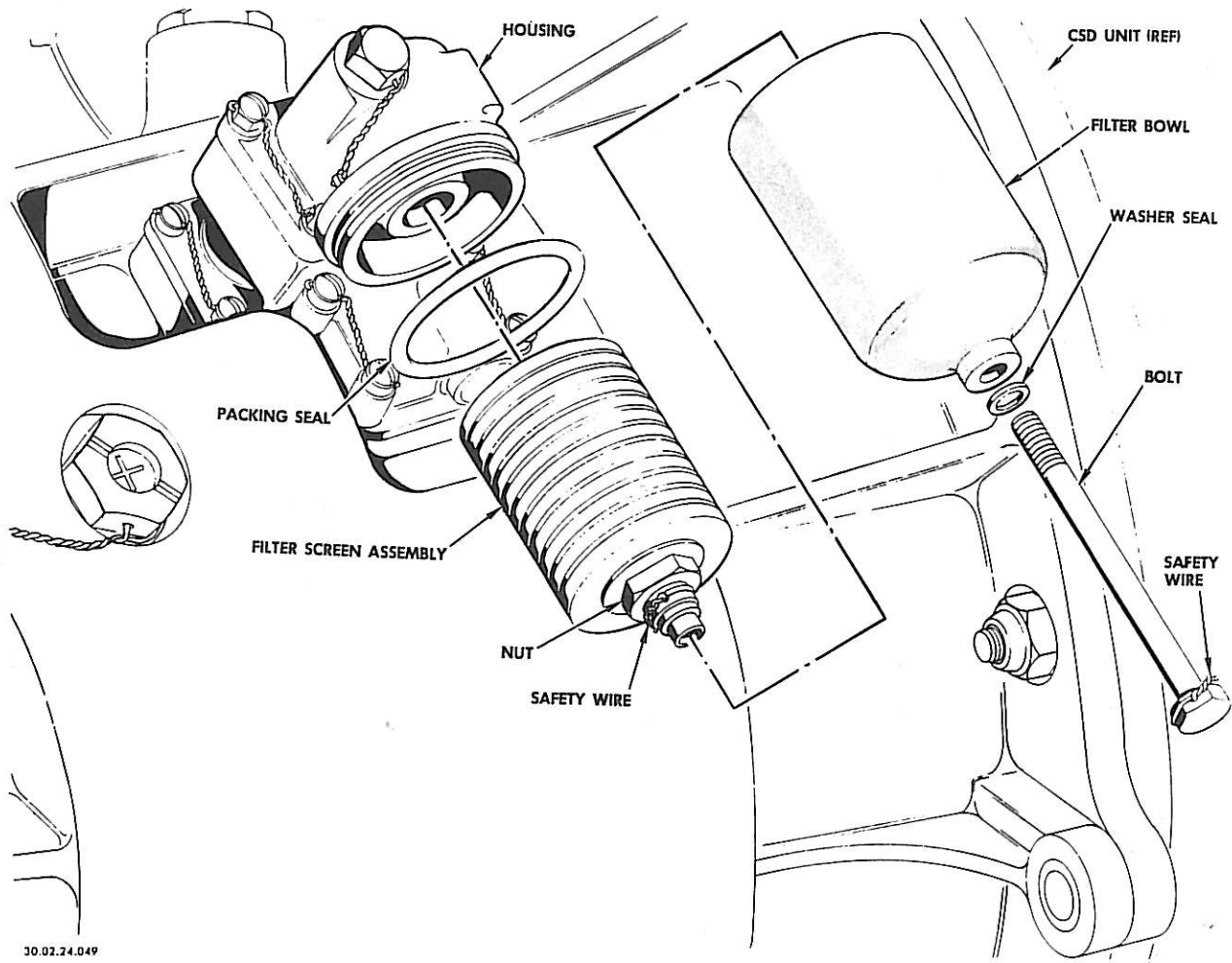
CAUTION: MAKE SURE OIL LINES ARE NOT KINKED.

(10) Fill CSD oil supply tank and quick disconnect cavity, (refer to Chapter 12, SERVICING).

(11) Install generator (refer to Section 24-2-1, Removal/Installation).

(12) Test system operation (refer to Section 24-2-1, Adjustment/Test).

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2. Removal/Installation CSD Unit Oil Filter (see Figure 202).

A. General.

The oil filter assembly should be periodically removed from the drive and cleaned.

B. Remove the Oil Filter from the Drive Housing.

- (1) Remove filter bowl and filter screen assembly, by cutting safety-wire and removing bolt.

CAUTION: DO NOT ALLOW THE FILTER SCREEN ASSEMBLY TO DROP FREE FROM THE FILTER HOUSING OR BOWL DURING DISASSEMBLY.

- (2) Install suitable plugs in both ends of filter screen assembly shaft to prevent entry of foreign matter when submerged in cleaning fluid. It is not necessary to disassemble filter screen assembly for cleaning unless desired. However, if it is disassembled, it is necessary to plug the center of each element to prevent entry of foreign matter during cleaning.

CAUTION: IMPROPER COMPLIANCE WITH THE PRECEDING PARAGRAPH COULD CAUSE DAMAGE OR POSSIBLE FAILURE OF THE DRIVE.

- (3) Immerse all parts in cleaning solvent, Federal Specification PS-661.
- (4) Use a soft hair brush to clean parts and then dry with moisture free air.

C. Install the Oil Filter on the Drive Housing.

- (1) If filter screen assembly was disassembled for cleaning, reassemble 12 filter elements, 13 spacers, and 2 washers.
- (2) Replace nut and torque to 5-10 inch-pounds and safety-wire.

- (3) Place filter screen assembly in filter bowl, insert bolt and tighten to drive mounting pad.

NOTE: Be sure service packing seal and washer seal are installed.

- (4) Torque nut to 30-35 inch-pounds and safety-wire.

- (5) Test system operation (refer to Section 24-1-0, Adjustment/Test).

3. Adjustment/Test CSD Magnetic Drain Plug

A. General.

The magnetic drain plug collects the ferrous particles within the drive indicating a possible internal failure. The plug's two magnetic poles are electrically insulated from each other. The presence of metal chips

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within the drive housing is indicated by an electrical check without removal of the drain plug.

B. Equipment Required - Ohmmeter.

C. Test Continuity of CSD Magnetic Drain Plug.

- (1) Connect one ohmmeter lead to the center threaded shaft of the drain plug.
- (2) Connect the other ohmmeter lead to the outer flange of drain plug or any convenient ground on the drive.
- (3) If continuity exists, indicating ferrous material in the drive sump and is confirmed by removal of the drain plug, remove the drive from service and send to overhaul (refer to Removal/Installation). The following examples and requirements will aid in determining drive condition and disposition:
 - (a) If any pieces of metal such as nuts, screws, retaining rings, etc. are evident, replace the drive.
 - (b) A fuzzy accumulation completely covering the magnetic chip detector is not acceptable, replace the drive.
 - (c) A slight amount of metallic fuzz is permissible providing the accumulated total is not more than enough to cover a 1/4 inch diameter circle.
 - (d) Six or more metallic chips longer than 3/16 inch and wider than 1/16 inch, regardless of thickness, are not acceptable and the drive must be replaced.
 - (e) Five or less metallic chips less than 3/16 inch long and 1/16 inch wide, regardless of thickness, are acceptable providing the filter and chip detector are checked after three hours of drive operation. If any chips are evident at this time the drive must be replaced.
 - (f) Evidence of silver plating (non-magnetic) mixed with metal particles is not acceptable and the drive must be replaced.

4. Adjustment/Test CSD Unit Underspeed Switch and Governor Solenoid Coils

A. Equipment Required - Ohmmeter.

B. Test continuity of CSD Underspeed Switch and Governor Solenoid Coils.

- (1) Remove electrical connector from drive load biasing solenoid and underspeed switch receptacle.
- (2) Connect ohmmeter leads across pins A and B of drive receptacle. Ohmmeter indication should be 550 (± 50) ohms.

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- (3) Connect ohmmeter leads across pins C and D of drive receptacle. Ohmmeter Indication should be 550 (± 50) ohms.

NOTE: The maximum allowable resistance difference between the AB coil and the CD coil is 50 ohms.

- (4) Connect one ohmmeter lead to shell of receptacle and one-by-one touch pins A, B, C and D with other ohmmeter lead. There should be no continuity.

NOTE: Steps (5) and (6) following are applicable to drive part Numbers 2CLKH4OB6 (or earlier models) and 2CLKH4OB7 respectively. Use applicable procedure.

- (5) Connect ohmmeter leads across pins E and F of receptacle. There should be no continuity.
- (6) Connect ohmmeter leads across pins F and G of drive receptacle. The ohmmeter indication should be less than one ohm.
- (7) Connect one ohmmeter lead to shell of drive receptacle and one-by-one touch pins E, F and G with other ohmmeter lead. There should be no continuity.

- (8) Replace electrical connector.

5. Adjustment/Test Thermal Switch and Disconnect Solenoid Coils

A. Equipment Required - Ohmmeter.

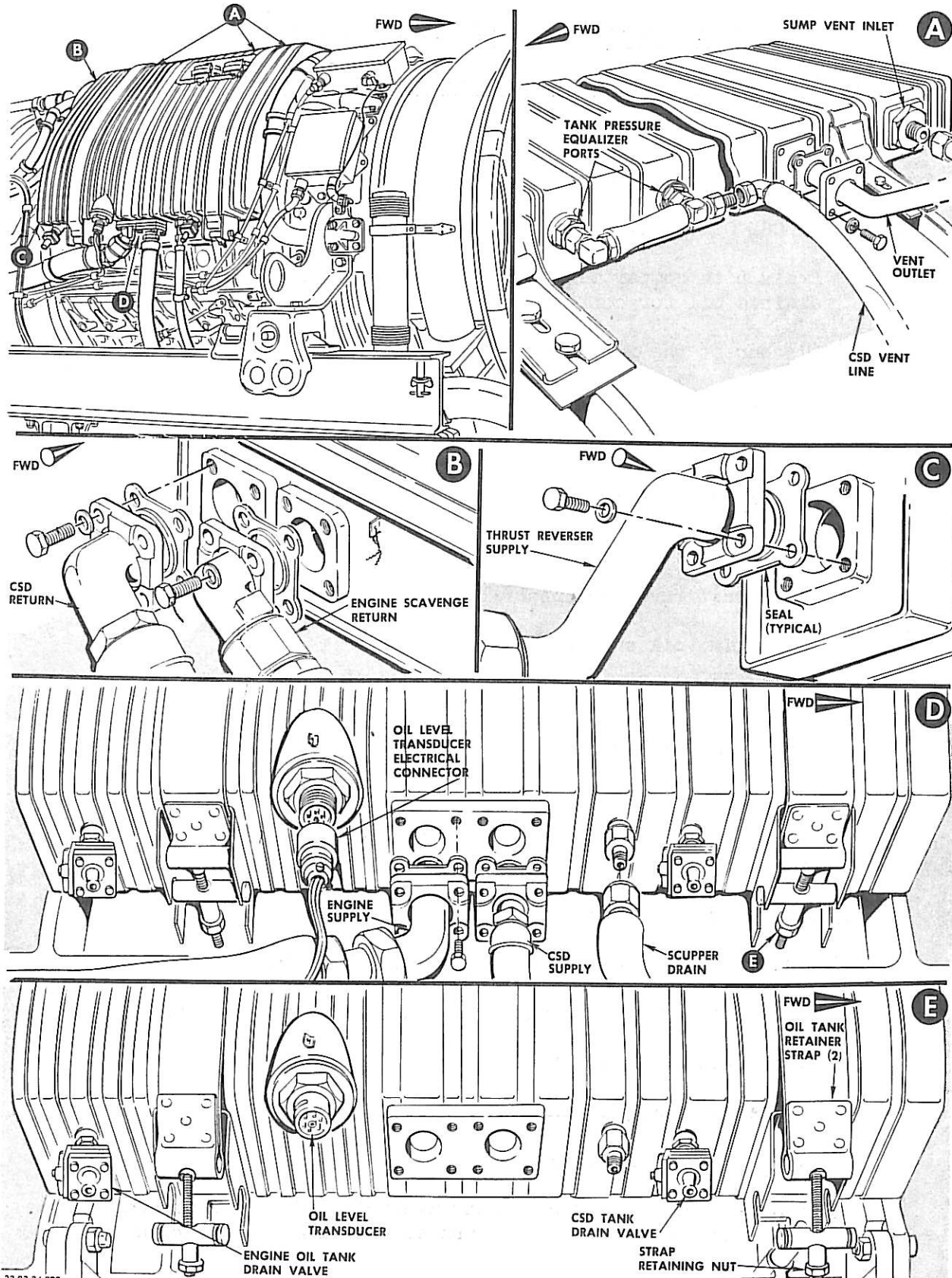
B. Test Continuity of Thermal Switch and Disconnect Solenoid Coils.

- (1) Remove CSD oil thermal switch and disconnect solenoid electrical connector from drive receptacle.
- (2) Connect ohmmeter leads across pins A and B of drive receptacle. There should be no continuity.
- (3) Connect ohmmeter leads across pins C and D of drive receptacle. The ohmmeter indication should be 2.3 ohms.
- (4) Connect one ohmmeter lead to drive receptacle shell and touch pins A through E with other lead. There should be no continuity.
- (5) Replace thermal switch and disconnect solenoid connector.

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CSD OIL SUPPLY TANK - MAINTENANCE PRACTICES

1. Removal/Installation CSD Oil Supply Tank (see Figure 201)
 - A. Equipment Required.
 - (1) A clean 5-gallon container.
 - B. Remove CSD Oil Supply Tank.
 - (1) Drain both compartments of oil tank in a clean container - check drained oil for contamination (refer to Chapter 12, **SERVICING**).
 - (2) Disconnect the following lines from oil tank.
 - (a) Vent lines (sump).
 - (b) Pressurizing line.
 - (c) CSD oil return line.
 - (d) Engine scavenge return line.
 - (e) Thrust reverser supply line.
 - (f) Engine oil supply line.
 - (g) CSD supply line.
 - (h) Scupper drain line.
 - (3) Remove electrical lead from oil level transducer.
 - (4) Loosen strap adjustment nuts until strap retainer can be slipped out of bottom brackets.
 - (5) Remove ignition lead brackets from tank.
 - (6) Pull bottom of tank away from engine, lift tank over ignition leads.
 - (7) Remove pressure equalizing line and fittings at top of tank.
 - (8) Remove oil level transducer from tank.
 - C. Install CSD Oil Supply Tank.
 - (1) Assemble pressure equalizing line and oil level transducer to tank.
 - (2) Position tank on engine - approximately 7/8-inch from compressor stator front flange. Rest tank on bottom mounting brackets.



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- (3) Install strap retainers in mounting bracket slots. Tighten adjustment nuts finger tight.
- (4) Install ignition lead brackets on tank.
- (5) Connect all tubing listed under removal step (2).
- (6) Connect electrical wiring harness for oil level transducer.
- (7) Tighten strap adjusting nuts.
- (8) Fill both compartments of tank with clean lube oil, Specification MIL-L-7808 (refer to Chapter 12, SERVICING).
- (9) Safety-wire connections.
- (10) Turn engine over with ignition OFF to purge system of air, and check for leaks (refer to Section 24-1-0, Maintenance Practices).
- (11) Recheck level of oil in both compartments of tank and fill to prescribed level (refer to Chapter 12, SERVICING).
- (12) Test system operation (refer to Section 24-1-0, Maintenance Practices).

OIL-TO-FUEL COOLER - MAINTENANCE PRACTICES

1. Removal/Installation Oil-to-Fuel Cooler (see Figure 201)

A. Equipment Required - Clean 1-gallon container.

B. Remove Cooler.

(1) Disconnect the following lines from cooler:

(a) Fuel in line.

(b) Fuel out line.

(c) Oil in line.

(d) Oil out line.

NOTE: Use a clean container to catch any fluid remaining in the lines.

(2) Remove harness clips attached to unit.

(3) Remove bolts attaching cooler to mounting brackets.

(4) Remove cooler.

C. Install Cooler.

(1) Place cooler on mounting brackets and secure with mounting bolts.

(2) Connect all hoses listed under removal step (1).

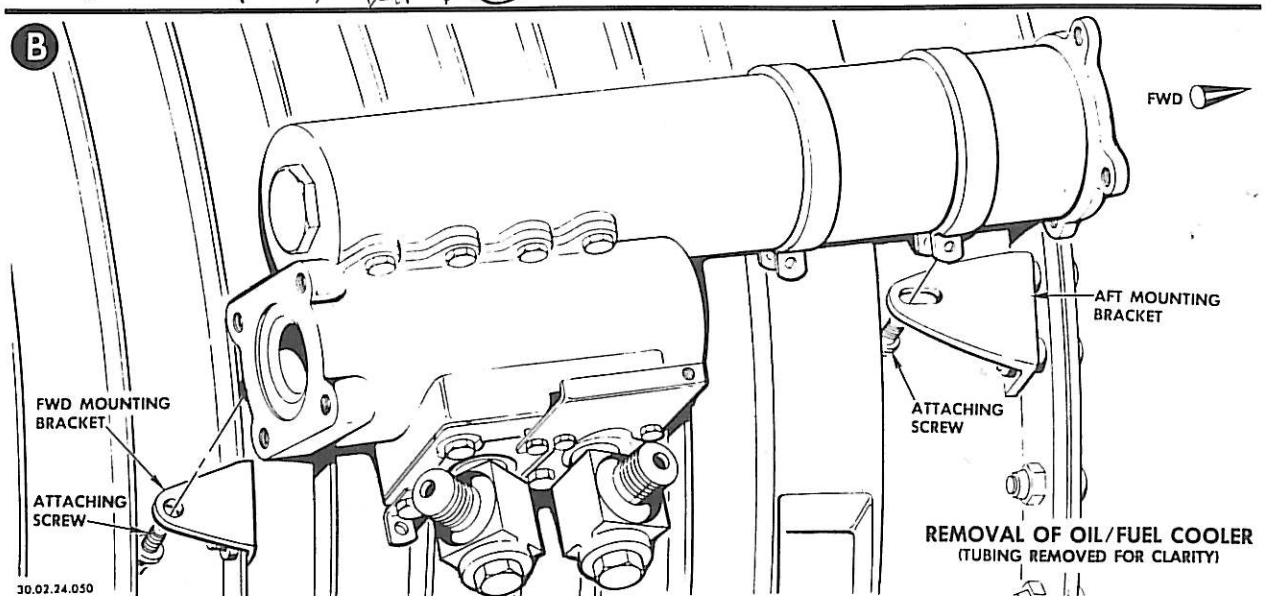
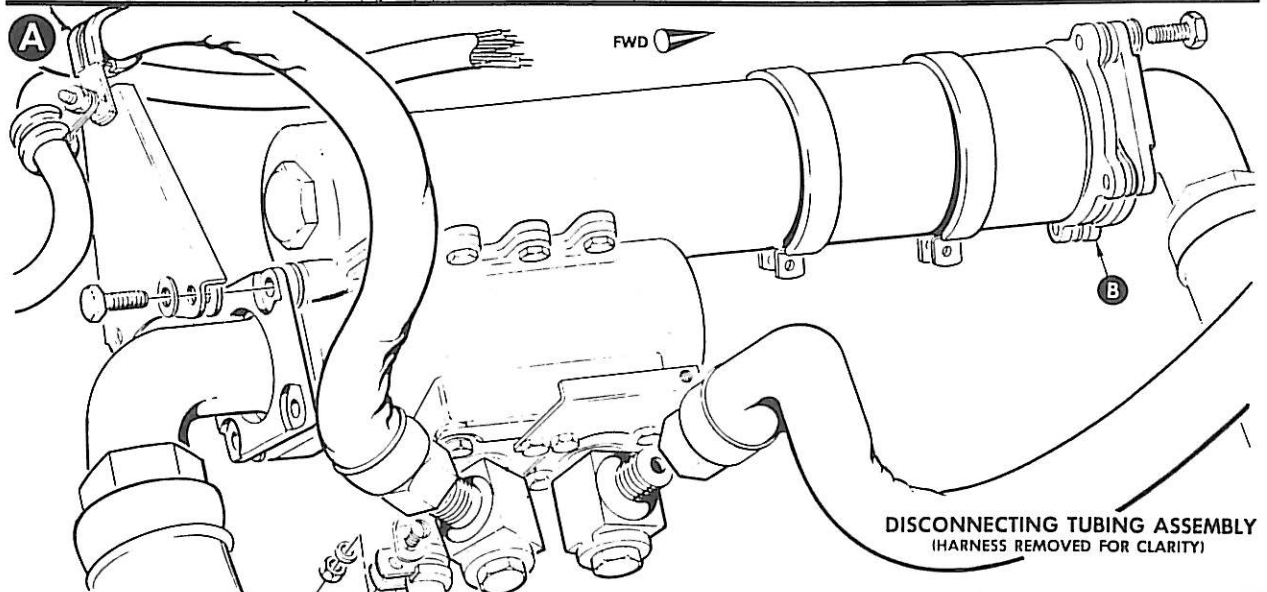
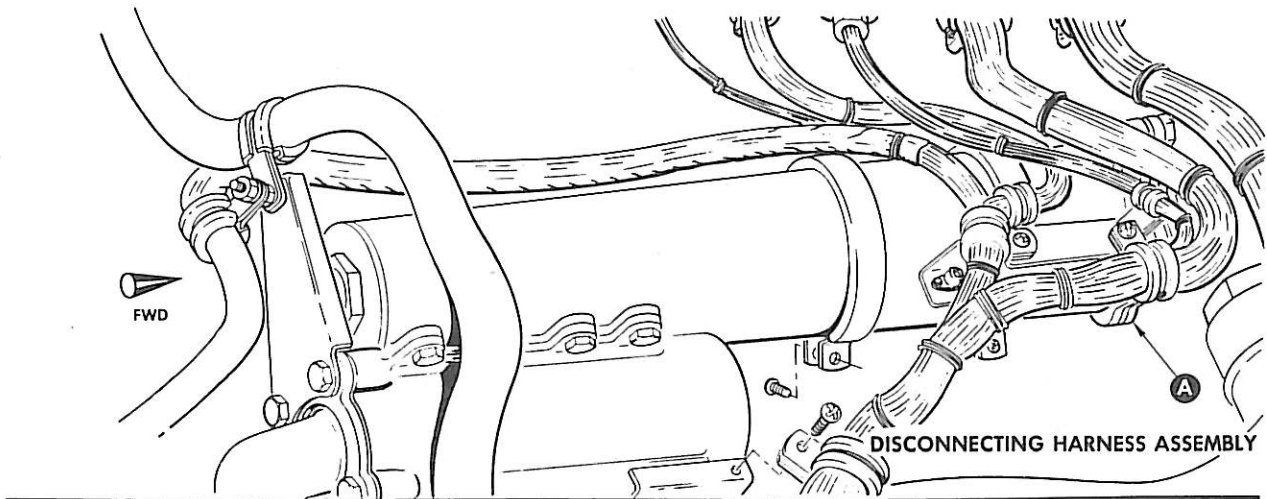
(3) Attach harness clips where removed.

(4) Safetywire connections.

(5) Turn engine over with ignition OFF to purge system of air and check for leaks (refer to Section 24-1-0, Maintenance Practices).

(6) Test system operation (refer to Section 24-1-0, Maintenance Practices).

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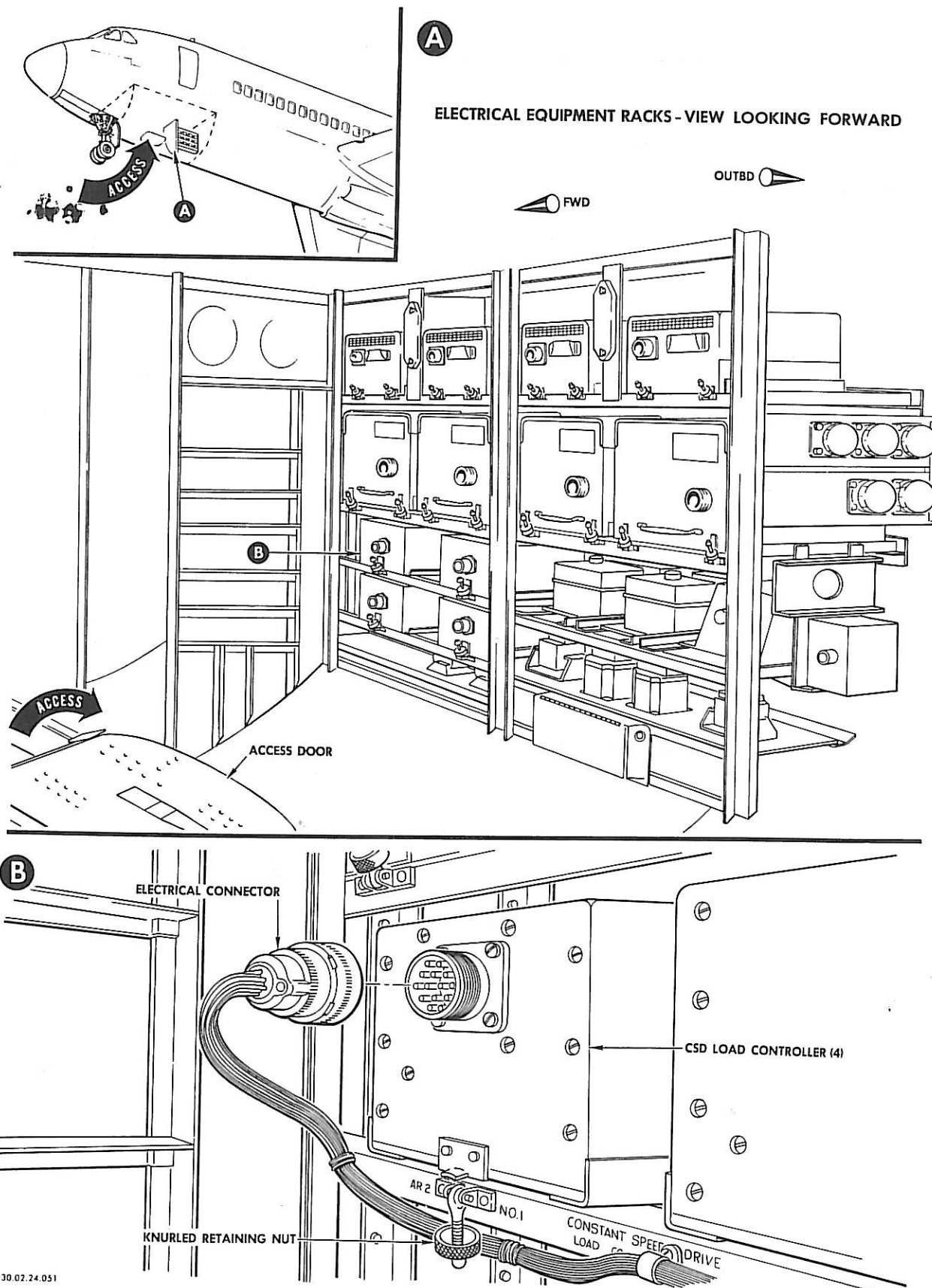


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MAINTENANCE MANUAL

LOAD CONTROLLER - MAINTENANCE PRACTICES

1. Removal/Installation Load Controller (see Figure 201)
 - A. Equipment Required - None.
 - B. Remove Load Controller.
 - (1) Deenergize the applicable ac system controls.
 - (2) Remove safety wire on knurled retaining nut and electrical connector.
 - (3) Remove electrical connector.
 - (4) Loosen knurled retaining nut and lift load controller from electric rack shelf.
 - C. Install Load Controller.
 - (1) Lift replacement load controller in position on second shelf of electric rack.
 - (2) Tighten knurled retaining nut.
 - (3) Insert and tighten electrical connector and safety-wire.
 - (4) Energize applicable ac system controls.
 - (5) Check system operation (refer to Section 24-1-0, Adjustment/Test).



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CSD QUICK-DISCONNECT SOLENOID CIRCUIT - TROUBLE SHOOTING

<u>POSSIBLE CAUSE</u>	<u>ISOLATION PROCEDURE AND CORRECTION</u>
1. <u>DISCONNECT SWITCH ACTUATED BUT QUICK-DISCONNECT ASSEMBLY DOES NOT OPERATE</u>	
A. Open circuit breaker.	Close applicable CSD CONT circuit breaker and recheck operation.
B. Faulty solenoid.	Remove electrical plug on drive unit and check continuity of solenoid coil. If no continuity replace drive.
C. Faulty disconnect switch.	Check for continuity through switch with switch actuated. If no continuity replace switch.
D. Airplane wiring faulty.	Check continuity of airplane wiring from circuit breaker to switch; then from switch to electrical plug on drive. If no continuity, repair or replace wiring.
E. Faulty disconnect mechanism.	Visually check disconnect mechanism at drive, if faulty replace drive

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MAINTENANCE MANUAL

CSD QUICK-DISCONNECT SOLENOID CIRCUIT - MAINTENANCE PRACTICES

1. Adjustment/Test CSD Quick-Disconnect Solenoid Circuit

A. General.

There are two approved methods for testing the CSD shaft disconnect operation. Either method is satisfactory, however, it is recommended that the first method be used whenever feasible.

B. Equipment Required - None.

C. Test CSD Shaft Disconnect Operation (Recommended Method).

- (1) Close applicable CSD CONT circuit breaker.
- (2) Pull reset knob out as far as it will go before operating the drive.
- (3) Operate drive at engine speeds above idle rpm with full generator load applied.
- (4) Place shaft disconnect switch, on flight engineer's ac generator control panel, in the DISC position.
- (5) Generator frequency shall immediately decrease to zero. This indicates a proper operation of the shaft disconnect.

NOTE: Failure of generator frequency to conform with the preceding step indicates a malfunction within the shaft disconnect assembly or disconnect solenoid circuit and must be corrected (refer to the Troubleshooting procedure).

- (6) Shut down engine and reset the shaft disconnect by pulling the red reset knob all the way out.

CAUTION: NEVER RESET THE SHAFT DISCONNECT WHILE THE ENGINE IS OPERATING.

- (7) Open CSD CONT circuit breaker.

D. Test Solenoid and Electrical Wiring (Alternate Method).

- (1) Close the applicable CSD CONT circuit breaker.
- (2) Be sure the red reset knob on drive is pulled out as far as it will go.
- (3) With engine shut down and electrical power supplied to airplane, place the disconnect switch, on the flight engineer's ac generator control panel, to the DISC position.

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- (4) An audible sound of the disconnect solenoid releasing the disconnect mechanism shall be noted at the drive.
- (5) The red reset knob shall assume a new position of approximately 1/4 inch closer to the drive.
- (6) If the conditions outlined in the preceding steps are not noted, an electrical malfunction is present in the actuating solenoid or electrical system and must be corrected. (Refer to Trouble Shooting.)
- (7) Reset shaft disconnect by pulling the red reset knob out all the way.

CAUTION: DO NOT START ENGINE WITHOUT RESETTING THE SHAFT DISCONNECT AS FULL DISENGAGEMENT MAY NOT BE OBTAINED. THIS COULD RESULT IN POSSIBLE DAMAGE TO THE DISCONNECT MECHANISM.

MAINTENANCE MANUAL

NORMAL AC POWER SYSTEM - DESCRIPTION AND OPERATION1. Description

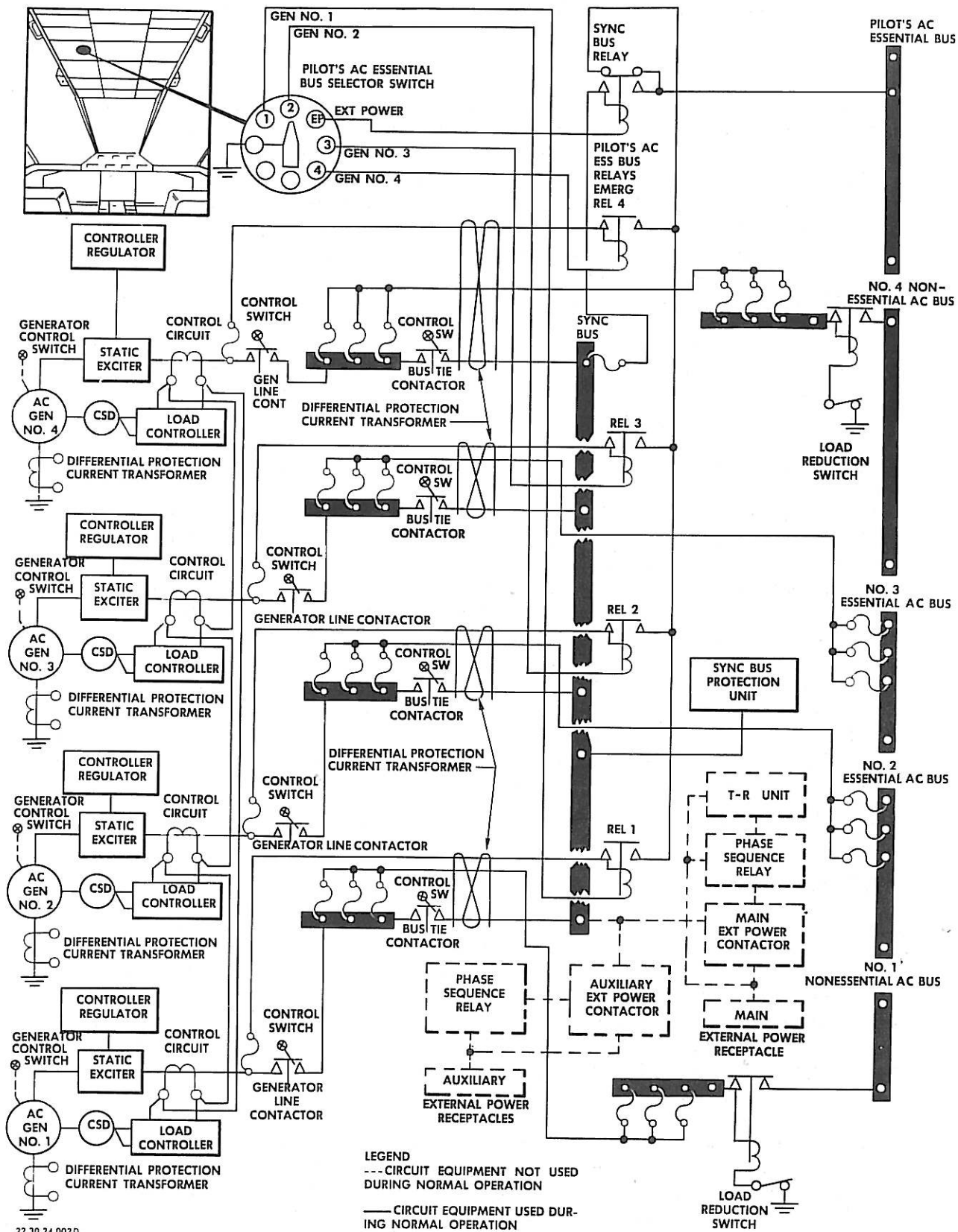
The normal ac power supply system (see Figure 1) consists of generators, static exciters, controller-regulator units, feeder lines, distribution buses, control switches, indicators and warning lights. During normal operation the four generators connect in parallel to the synchronizing (sync) bus and the five load buses are energized. Generator output power routes to the distribution buses through feeder lines and is isolated from the load bus by the generator line contactor or from the sync bus by the bus tie contactor. Bus voltage is available for either 3-phase or single-phase circuit operation whenever the generators are operating. Although normal operation consists of all generator outputs connected in parallel, isolated operation is accomplished by the flight engineer through manipulation of the control switches mounted on the generator control panel; see Figure 2. System isolation occurs automatically when certain fault conditions are sensed by the controller regulator protective circuits.

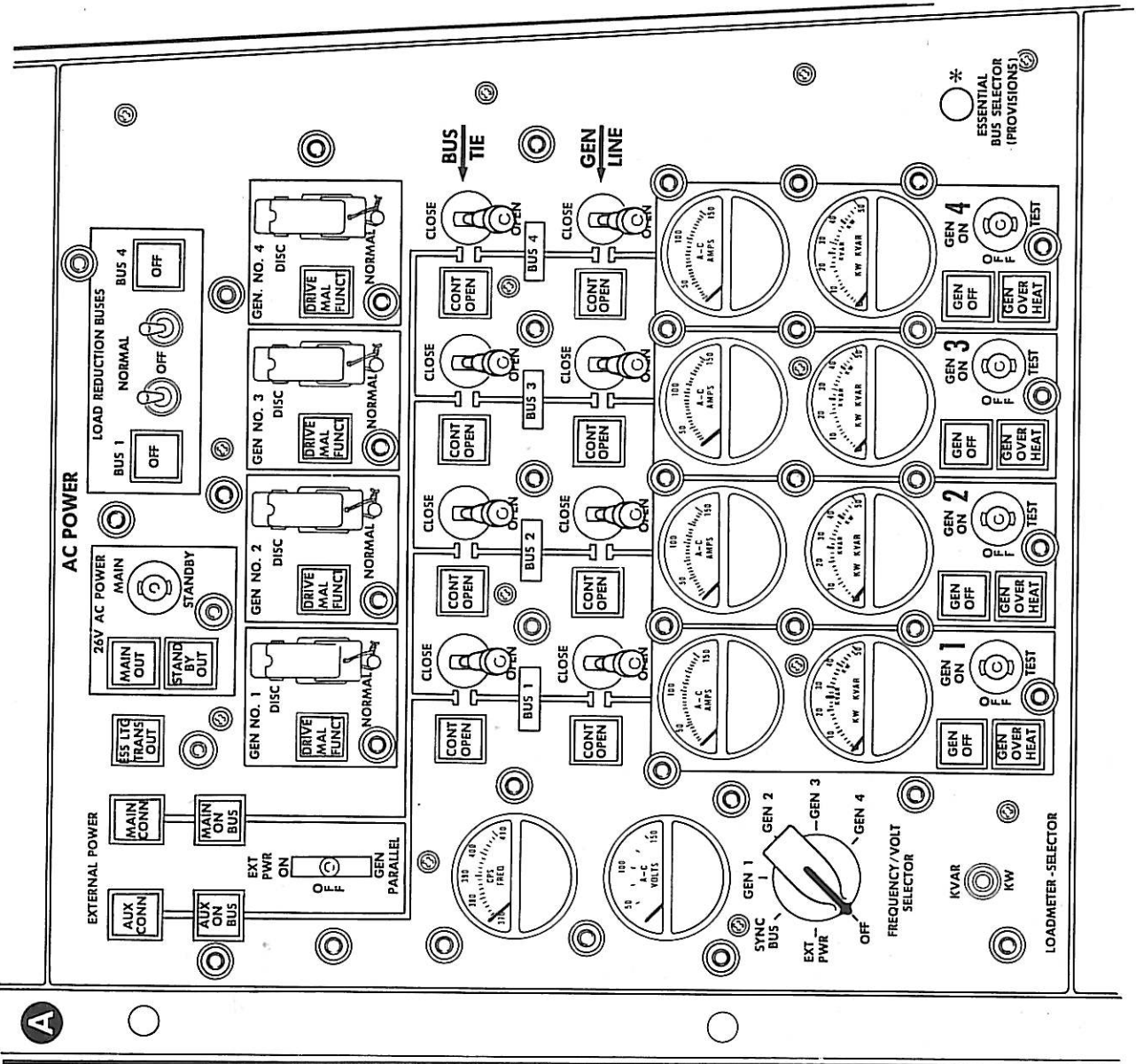
Under certain conditions, the generator line contactor control switch connects the generator to its own load bus, and the bus tie contactor control switch connects the generator to the sync bus, when the generators are operating in parallel. The pilots' ac essential bus be energized from any generator or from external power. The generator load buses are numbered 1, 2, 3, and 4 and are normally energized by their respectively numbered generator. However, failure of a generator does not constitute the loss of its load bus because any load bus can be energized from the sync bus. Buses No. 1 and 4 are nonessential and are disconnected from the sync bus to prevent overloading should generator No. 2 and/or 3 become inoperative. Buses No. 2 and 3 and the pilots' bus are considered essential. The three essential buses supply all power for normal flight operations including that required for passenger comfort. Any other system or duplicate system connects to the nonessential buses. Optional selection of any generator to supply power for the pilots' ac essential bus is possible by moving the pilots' ac essential bus selector switch to the desired generator position.

2. Operation

Prior to an engine start, an external power unit must be connected to the external power receptacles on the forward right side of the fuselage. (Refer to Section 24-3-0 for a complete description of the external ac power system.) As each engine starts, the CSD unit output speed increases until it comes up to operating speed. The underspeed switch (in the CSD unit) closes. The closing of this switch indirectly places flashing power on the generator field, supplied from the permanent magnet generator, and generator voltage buildup commences.

When the generator reaches rated voltage, and with the generator line switch closed, the bus tie contactor opens and the generator line contactor closes. The generator then assumes the load on its load bus and is isolated from the sync bus. In this case, the No. 1 generator supplies its own load bus, and external power supplies the sync bus which connects to





EFFECTIVITY	
APPLICABLE TO AIRPLANES	
*	CV1 THROUGH CV25

MAINTENANCE MANUAL

load buses No. 2, 3, and 4. Although each generator assumes the load on its respective load bus, the sync bus remains energized from the ground power source. When the external power control switch is momentarily placed in the generator parallel position, the external power contactor opens and the sync bus deenergizes. A generator preferential circuit selects the first available generator to be placed on the sync bus in the order of No. 1, 2, 3, and 4 generator to reenergize the sync bus and close the associated generator bus tie contactor. Automatic paralleling is thereby initiated and as each remaining generator enters the required phase and voltage range, the related automatic paralleling system closes the bus tie contactors and all four generators are in parallel operation connected to the sync bus.

Although not normal, isolated operation of each generator is possible, either manually or automatically. Manual isolation is accomplished by manipulation of the bus tie contactor control switches to the OPEN position. This switch action opens the bus tie contactor to disconnect the load bus from the sync bus. A generator is automatically isolated from the sync bus if the protective circuit senses a fault in that particular generator system.

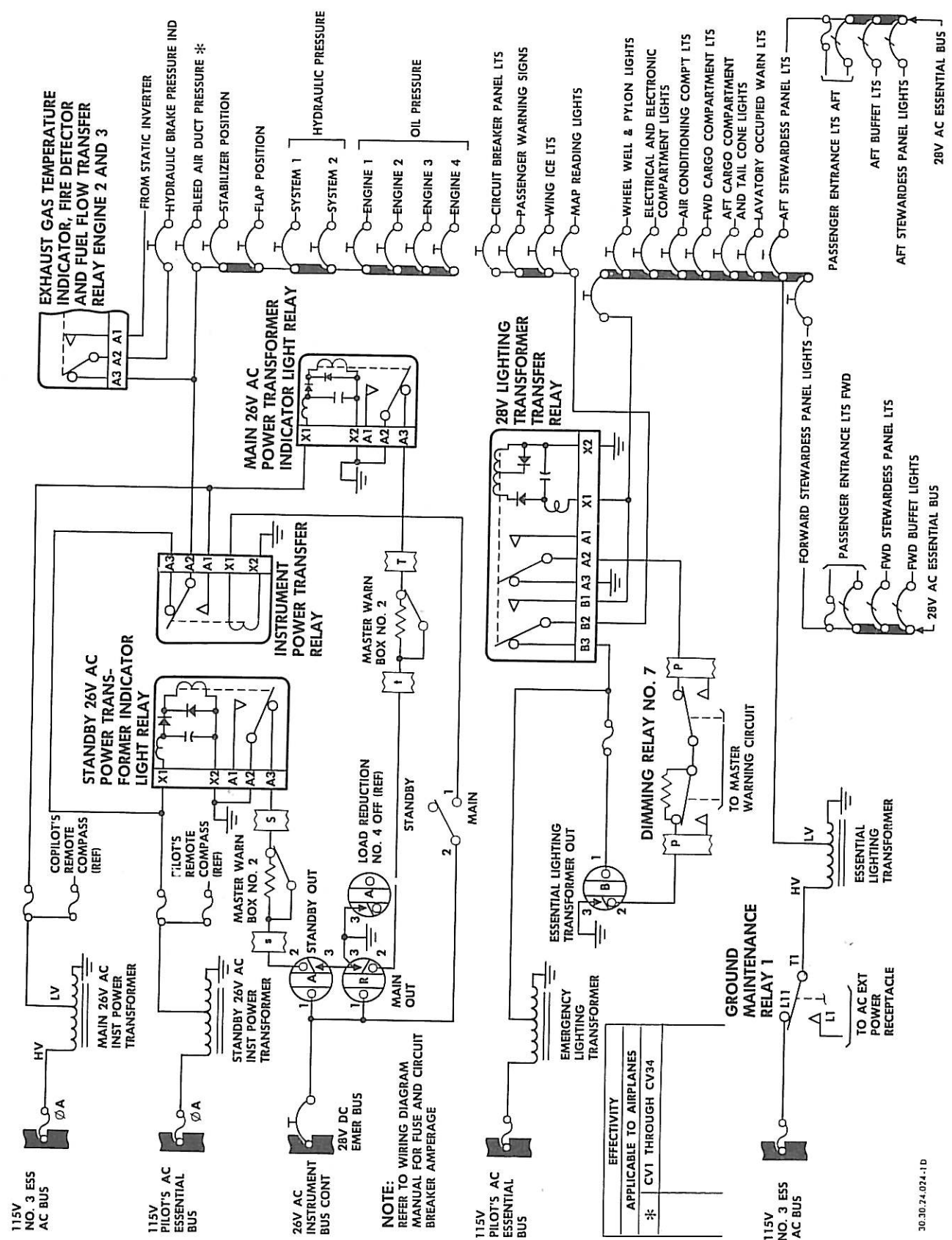
To return to ground power, the external power supply is connected to the airplane prior to engine shutdown. Moving the external power switch to the ON position will deenergize the bus tie contactors, thereby leaving each load bus connected to its respective generator and at the same time connecting the sync bus to the external ac power supply. When the engines are shut down, the generator line contactors open, the bus tie contactors close. External power thereby energizes all load buses via the sync bus. With the load buses energized, the transformer-rectifier (T-R) units supply 28-volts dc to the dc load buses.

3. AC Power Distribution (see Figure 3)

The ac power distribution system consists of three essential buses (Pilots' No. 2 and No. 3) and two nonessential buses (No. 1 and No. 4) and all wiring connecting these load buses to the circuit breakers for individual circuit operation. As the bus titles imply, all ac circuits are considered either essential or nonessential and are placed accordingly on the buses. Basically the essential circuits are those related to equipment required to safely fly the airplane; nonessential circuits can usually be disconnected from the load without hampering flight operations.

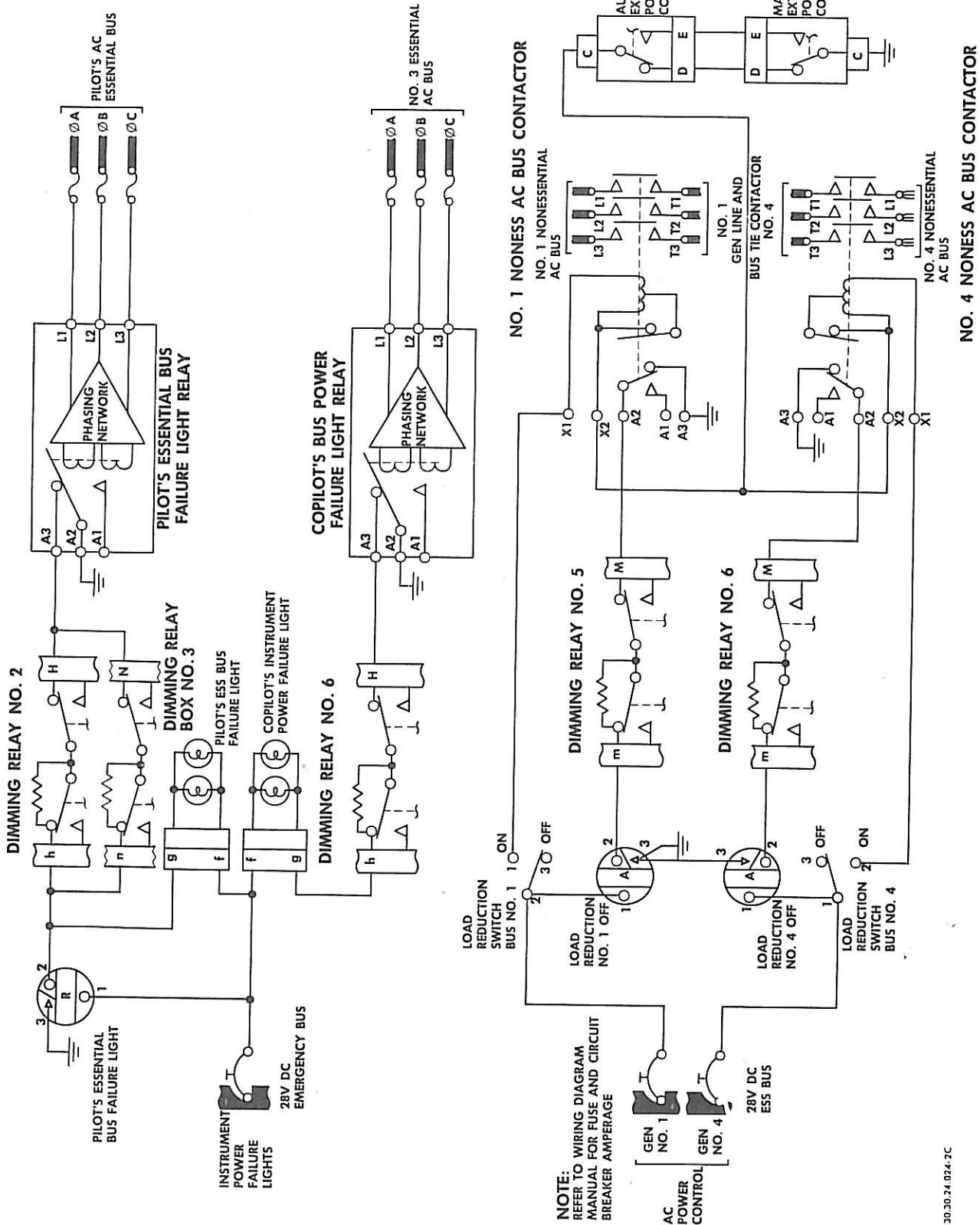
The five main distribution buses each consist of three buses to which 115/200-volt, 3-phase loads or 115-volt, single-phase loads are connected. Where lower voltages are required for circuit operation, stepdown transformers supply the desired output voltage.

The three essential buses connect directly to the generator line and bus tie contactor output feeder lines, thereby receiving power whether the ac system is in parallel or isolated operation. The nonessential bus power passes through the closed contacts of the load reduction relays prior to connecting to the buses if the associated load reduction control switches are ON. These contactors are deenergized to interrupt power flow



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AB-3

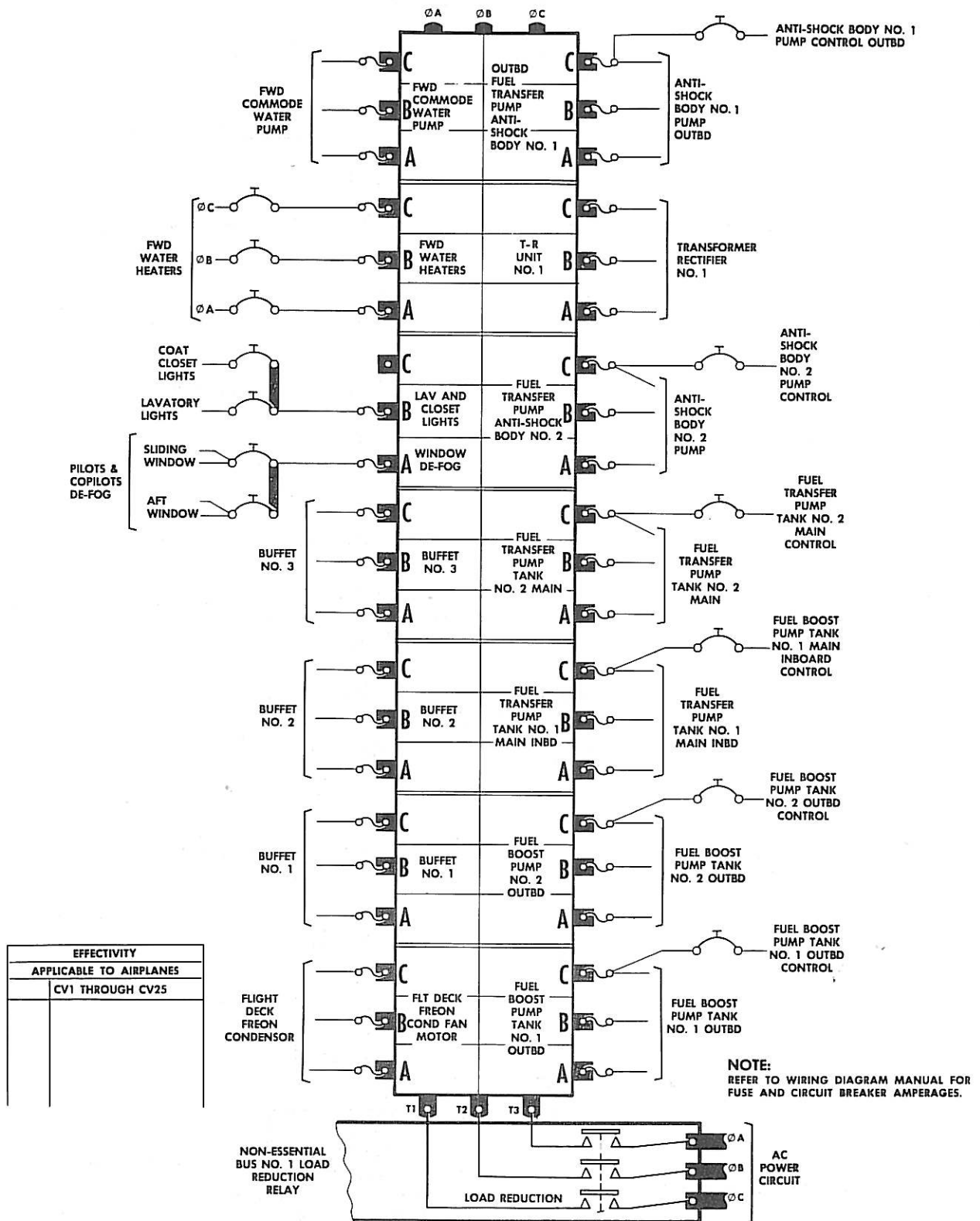
AC Power Distribution System
Figure 3 (Sheet 1 of 18)



CONVAIR MODEL 30

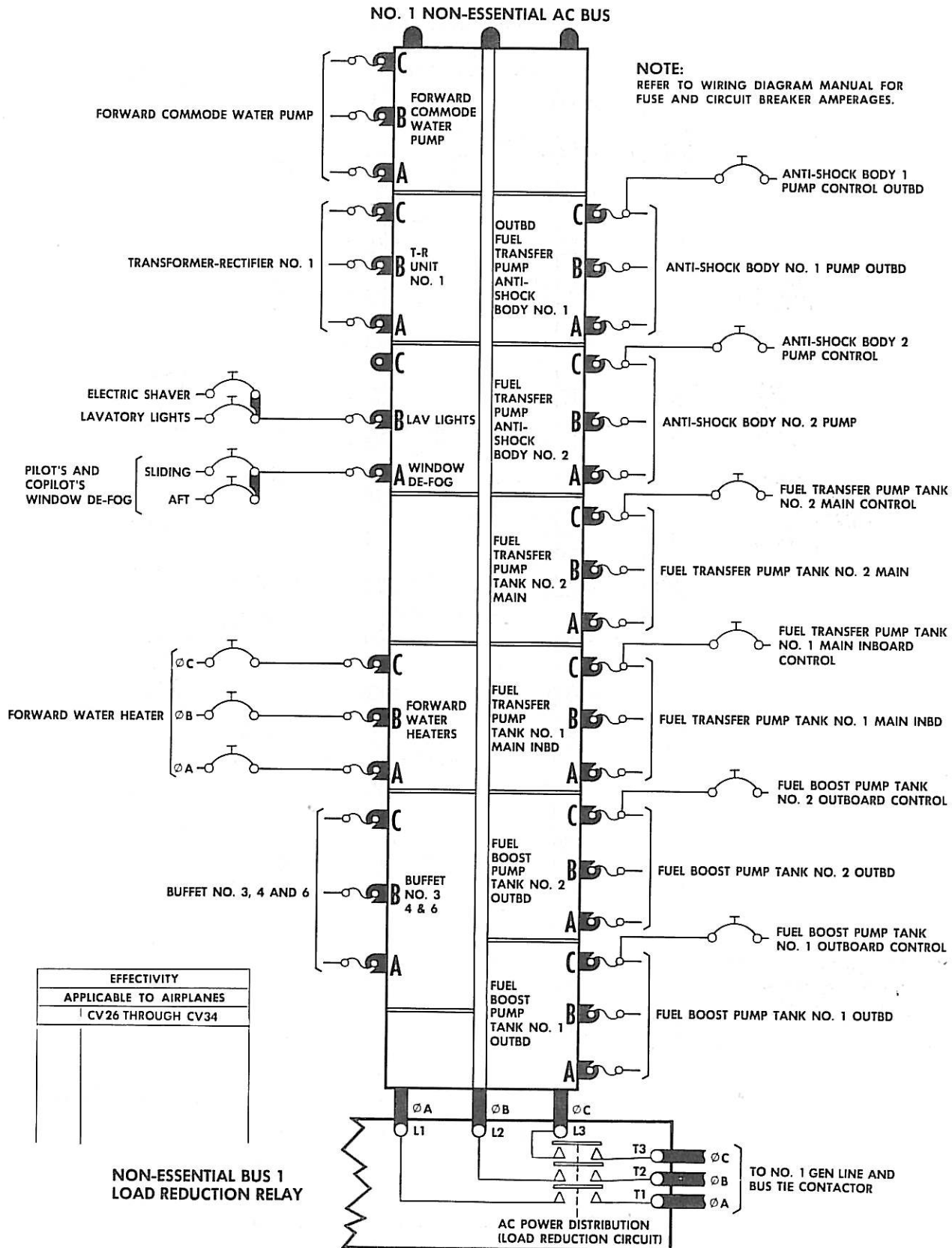
MAINTENANCE MANUAL

NO. 1 NONESSENTIAL AC BUS



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MAINTENANCE MANUAL

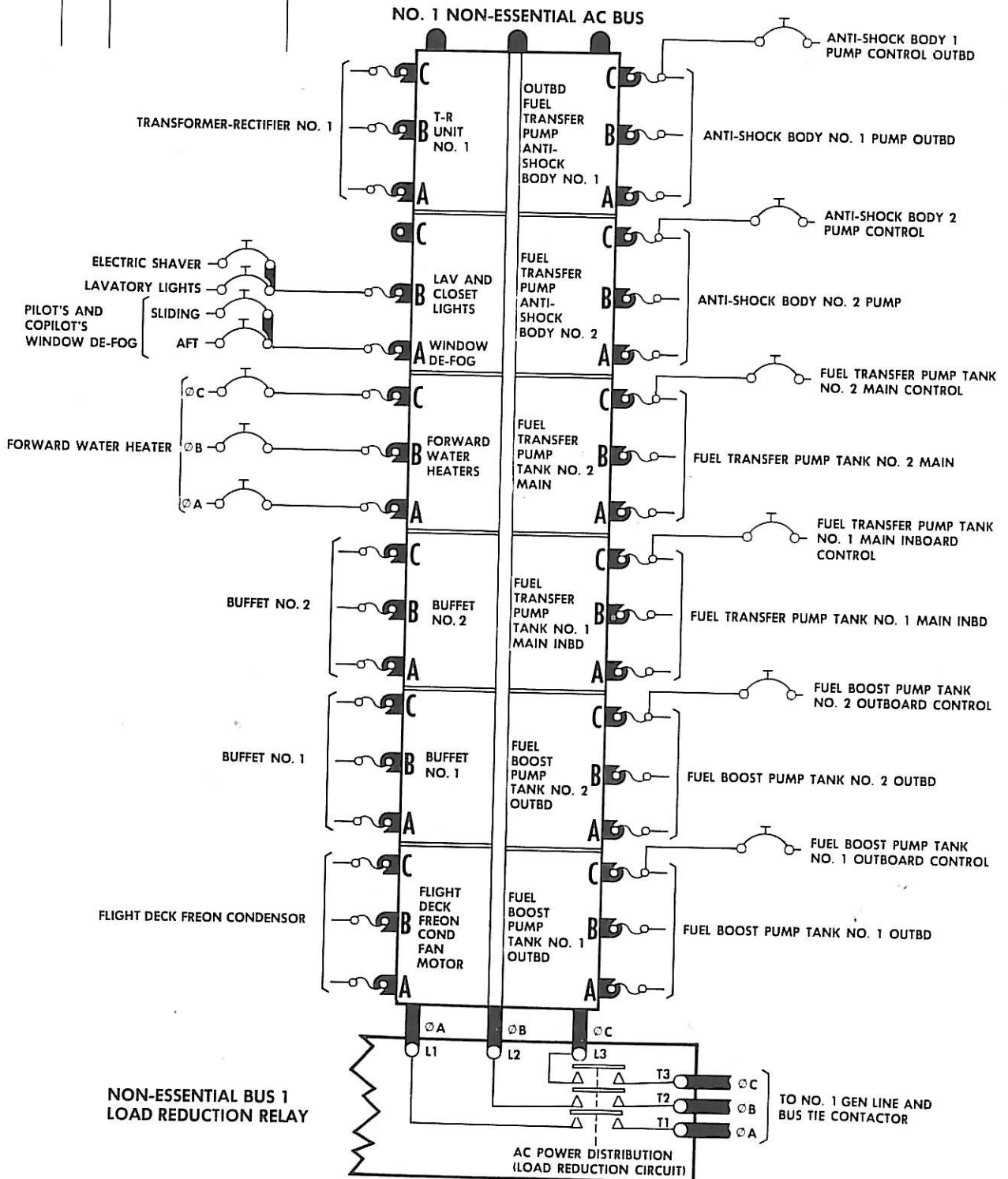


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MAINTENANCE MANUAL

EFFECTIVITY	
APPLICABLE TO AIRPLANES	
CV35 AND ON	

NOTE:
REFER TO WIRING DIAGRAM MANUAL FOR
FUSE AND CIRCUIT BREAKER AMPERAGES.

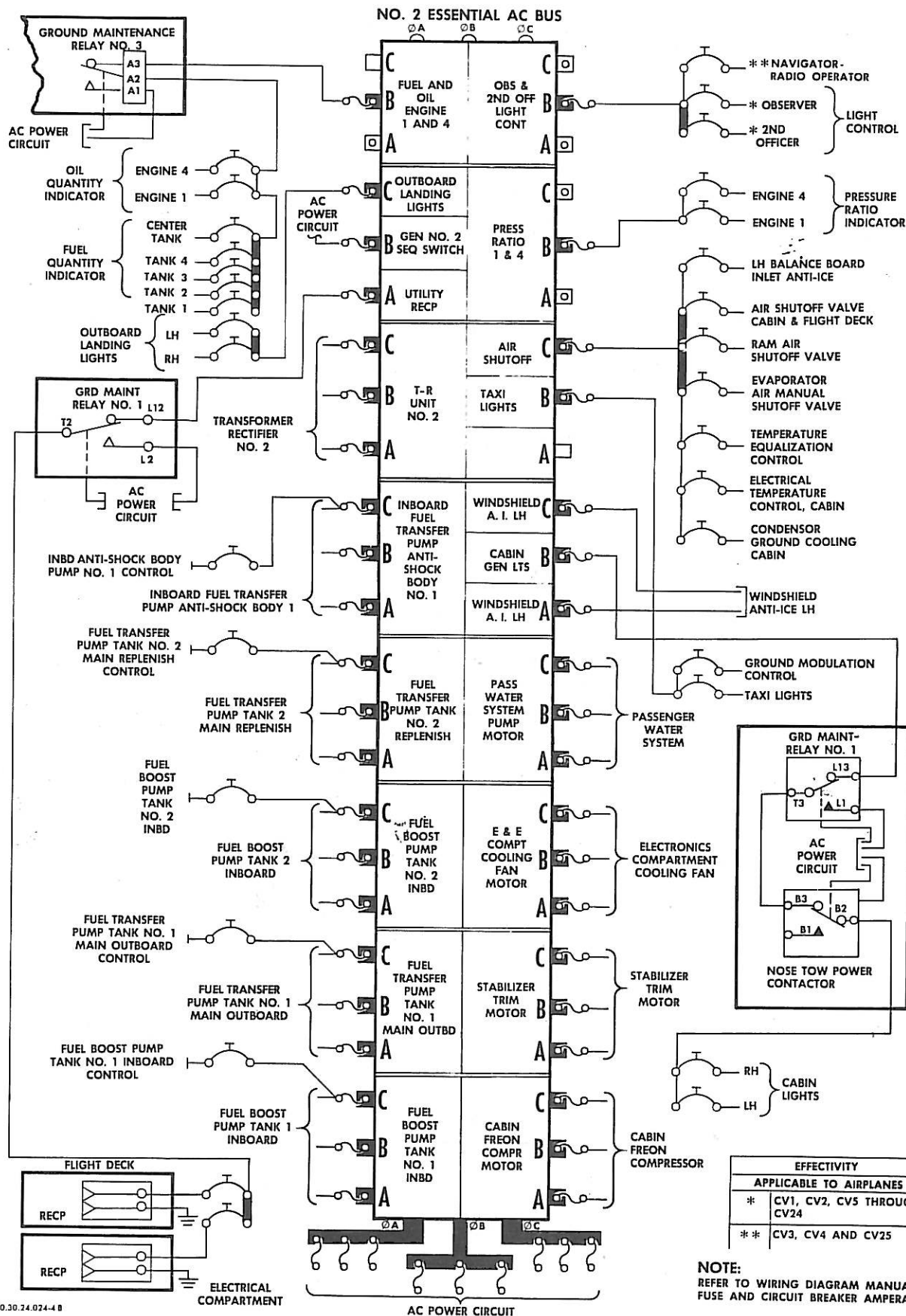


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AB-1

AC Power Distribution System
Figure 3 (Sheet 5 of 18)

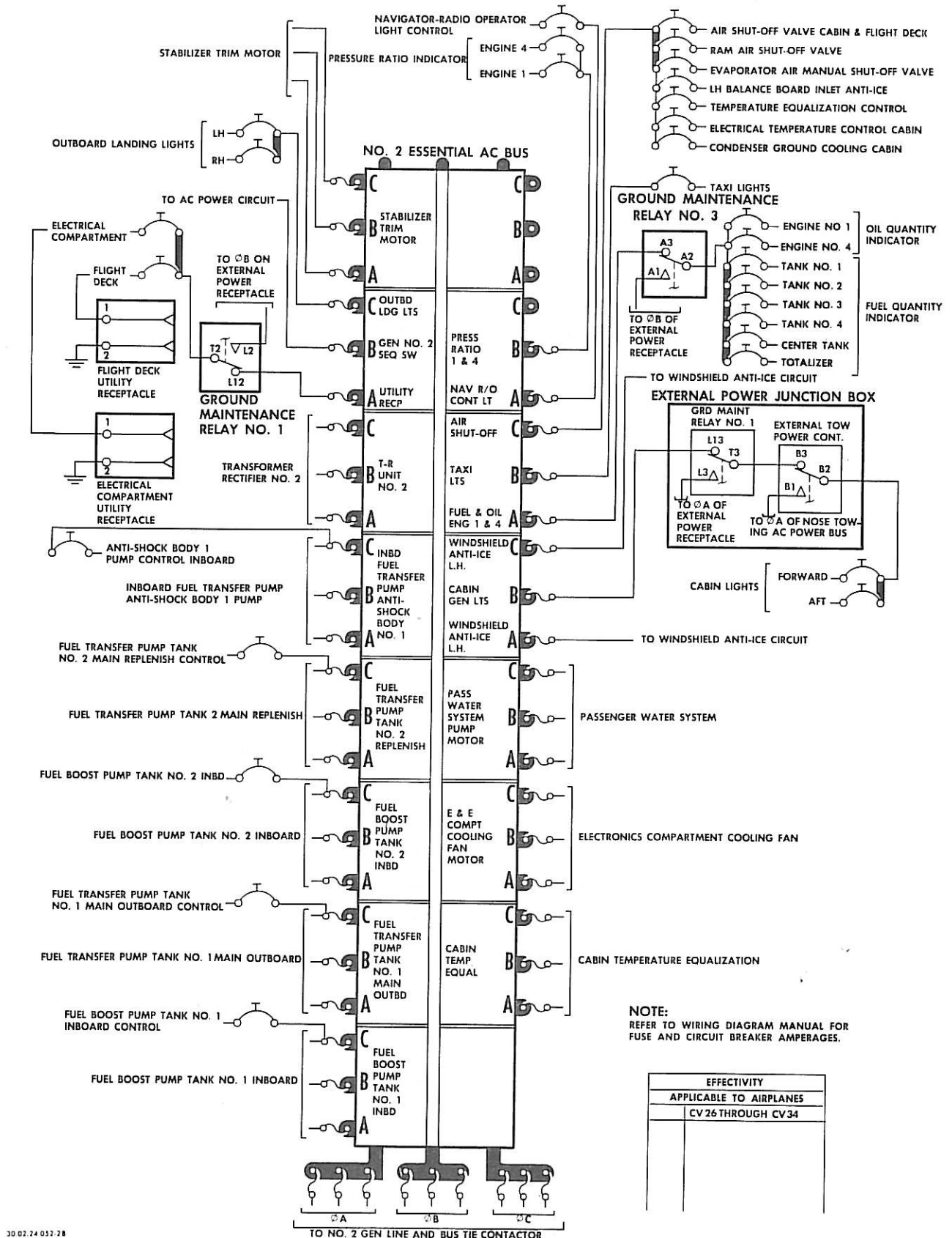
24-2-0
Page 9



EFFECTIVITY	
APPLICABLE TO AIRPLANES	
*	CV1, CV2, CV5 THROUGH CV24
**	CV3, CV4 AND CV25

NOTE:
REFER TO WIRING DIAGRAM MANUAL FOR FUSE AND CIRCUIT BREAKER AMPERAGES.

MAINTENANCE MANUAL



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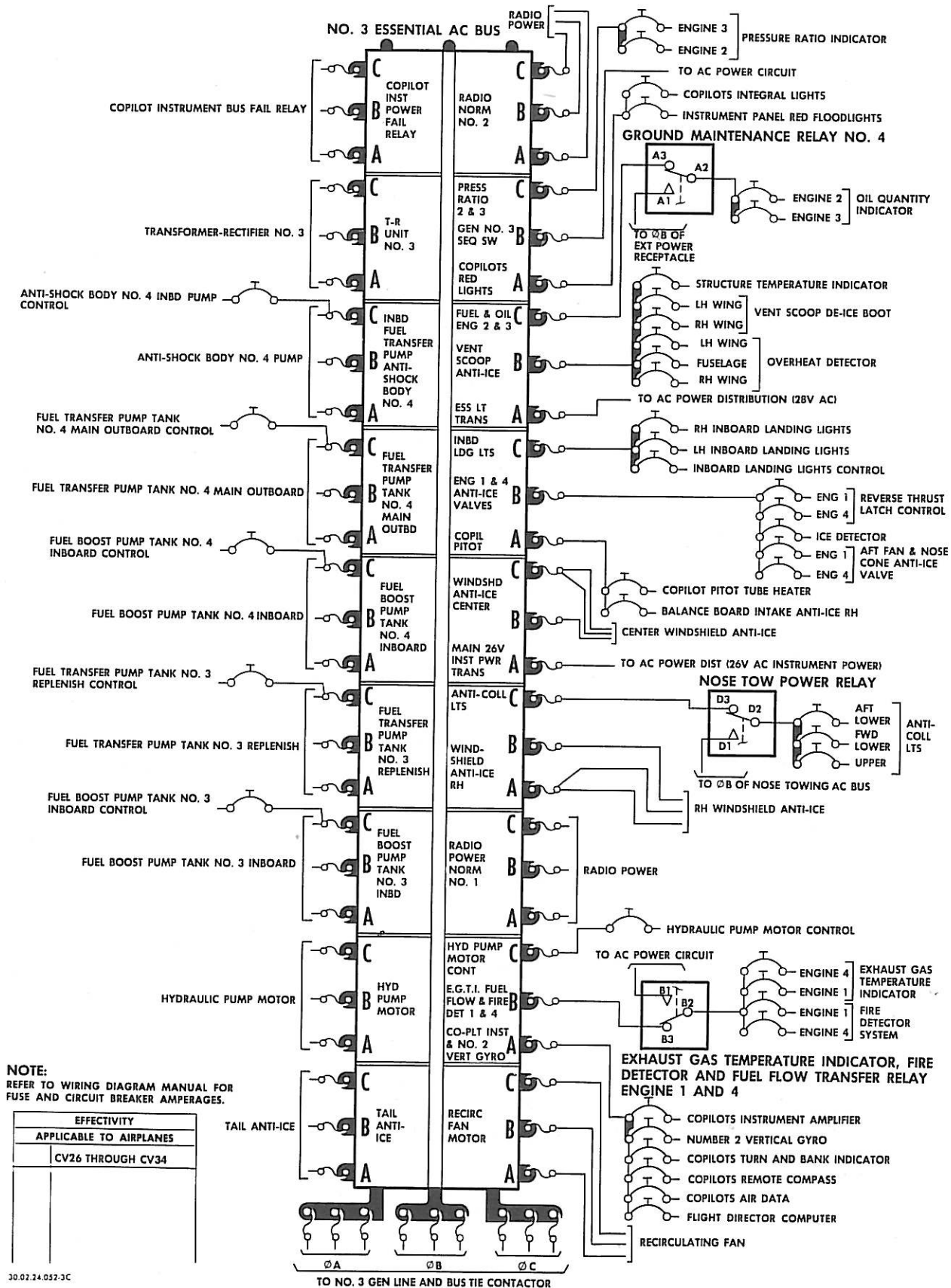


NOTE:
REFER TO WIRING DIAGRAM MANUAL FOR
FUSE AND CIRCUIT BREAKER AMPERAGES.

EFFECTIVITY	
APPLICABLE TO AIRPLANES	
	CV1 THROUGH CV25
*	CV3, CV4 AND CV25

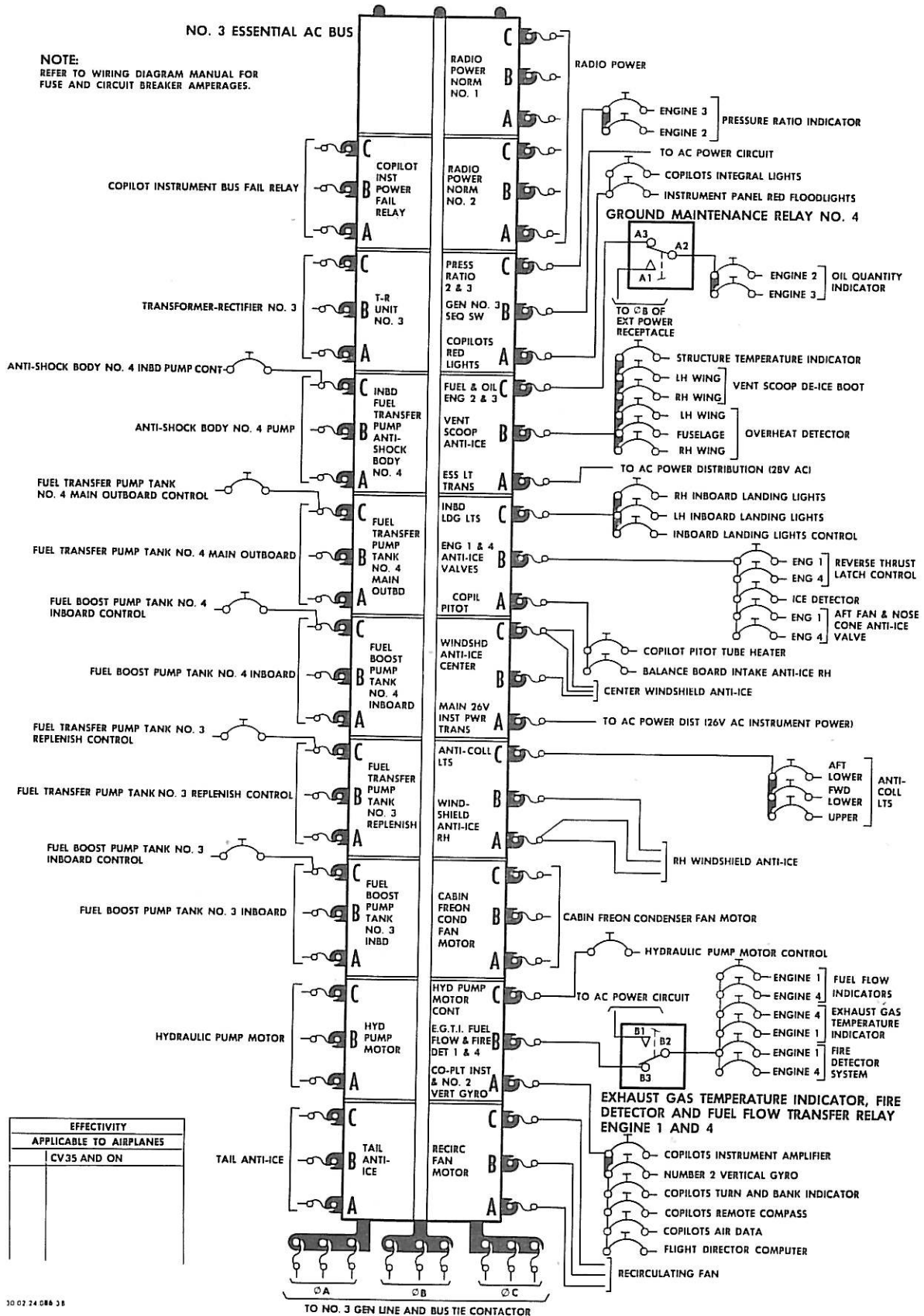


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AC Power Distribution System
Figure 3 (Sheet 11 of 18)

NOTE:
REFER TO WIRING DIAGRAM MANUAL FOR
FUSE AND CIRCUIT BREAKER AMPERAGES.

ANTI-SHOCK BODY NO. 4 PUMP OUTBOARD CONTROL

ANTI-SHOCK BODY NO. 4 OUTBD

ANTI-SHOCK BODY NO. 3 PUMP

ANTI-SHOCK BODY NO. 3 PUMP CONTROL

OUTBD FUEL TRANSFER PUMP

FUEL TRANSFER PUMP ANTI-SHOCK BODY NO. 3

FUEL TRANSFER PUMP TANK NO. 4 MAIN INBD CONTROL

AFT COMMODE WATER PUMP

FUEL TRANSFER PUMP TANK NO. 4 MAIN INBD

FUEL BOOST PUMP TANK NO. 4 OUTBOARD CONTROL

PASS RDG LT TRANS

FUEL BOOST PUMP TANK NO. 4 OUTBD

TEMPERATURE CONTROL FLIGHT DECK

GROUND COOLING FLIGHT DECK

FUEL TRANSFER PUMP TANK NO. 3 MAIN CONTROL

AFT LAVATORY HOT WATER HEATERS

FUEL TRANSFER PUMP TANK NO. 3 MAIN

FUEL BOOST PUMP TANK NO. 3 OUTBOARD CONTROL

BUFFET NO. 4

BUFFET NO. 4

FUEL BOOST PUMP TANK NO. 3 OUTBOARD

FLIGHT DECK FREON COMPRESSOR

AC POWER CIRCUIT

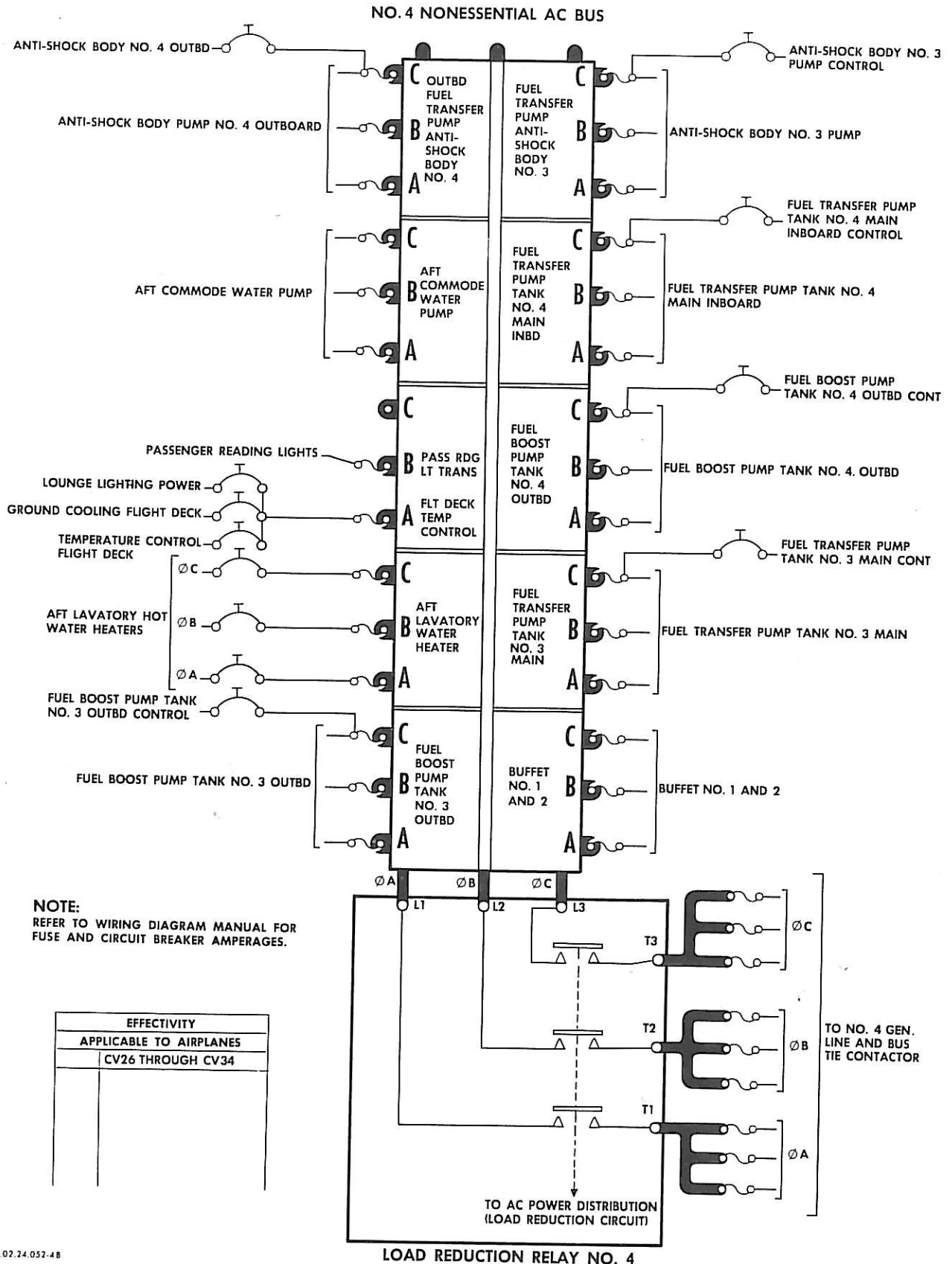
LOAD REDUCTION RELAY NO. 4

EFFECTIVITY	
APPLICABLE TO AIRPLANES	
CV1 THROUGH CV25	

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CONVAIR MODEL 30

MAINTENANCE MANUAL



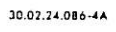
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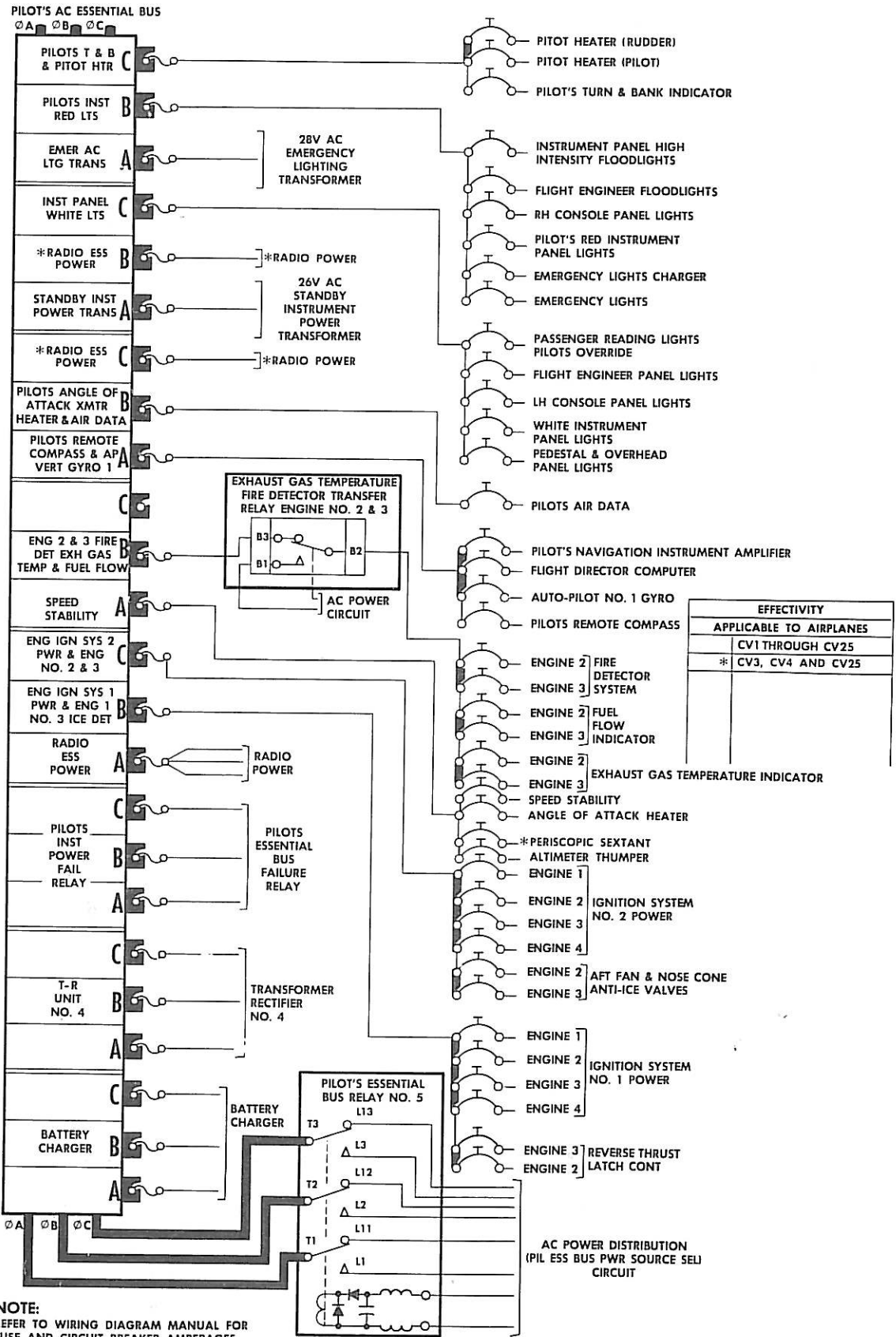
AC Power Distribution System
Figure 3 (Sheet 13 of 18)

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MAINTENANCE MANUAL



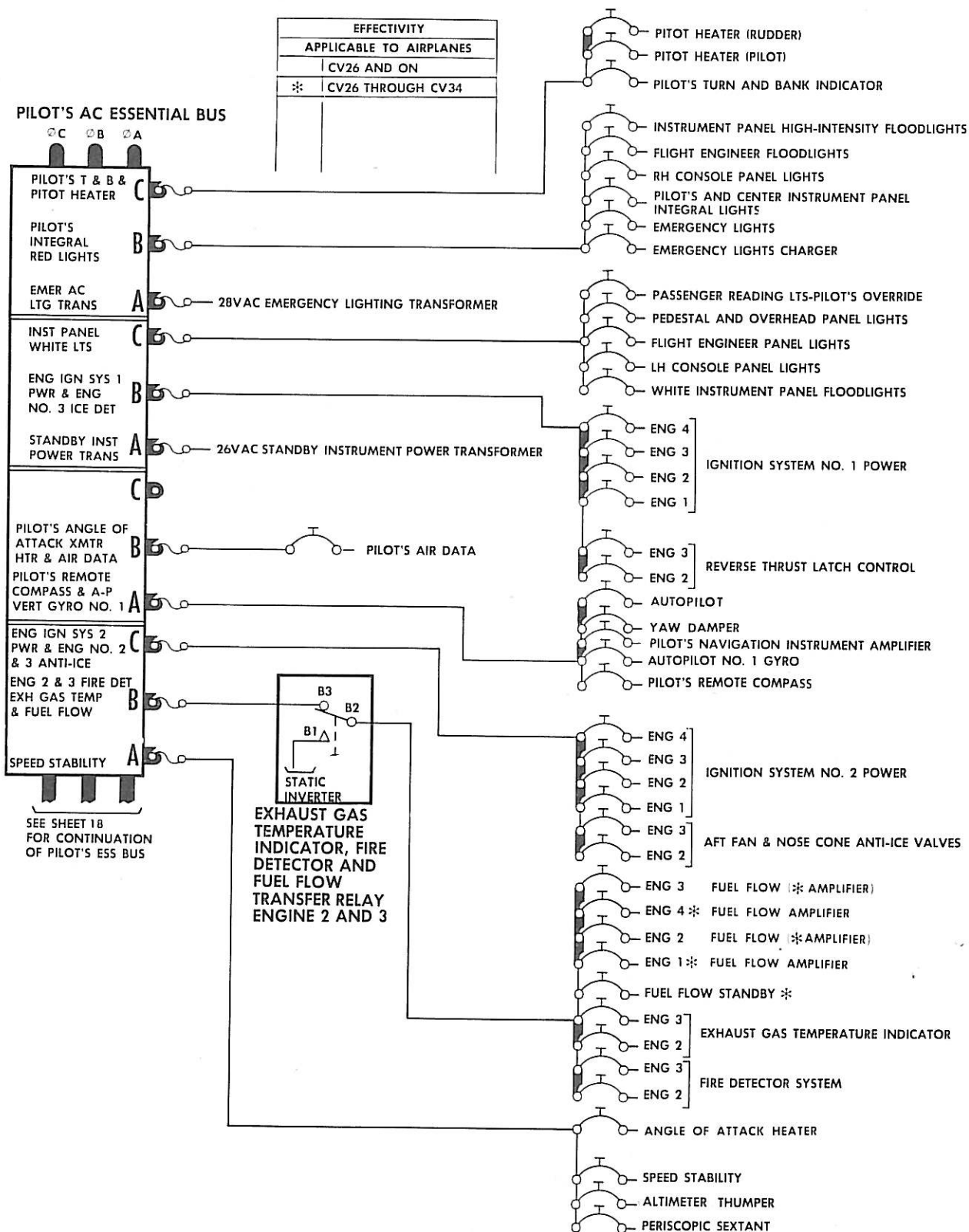
MAINTENANCE MANUAL



MAINTENANCE MANUAL

NOTE:

REFER TO WIRING DIAGRAM MANUAL FOR
FUSE AND CIRCUIT BREAKER AMPERAGES.



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CONVAIR MODEL 30

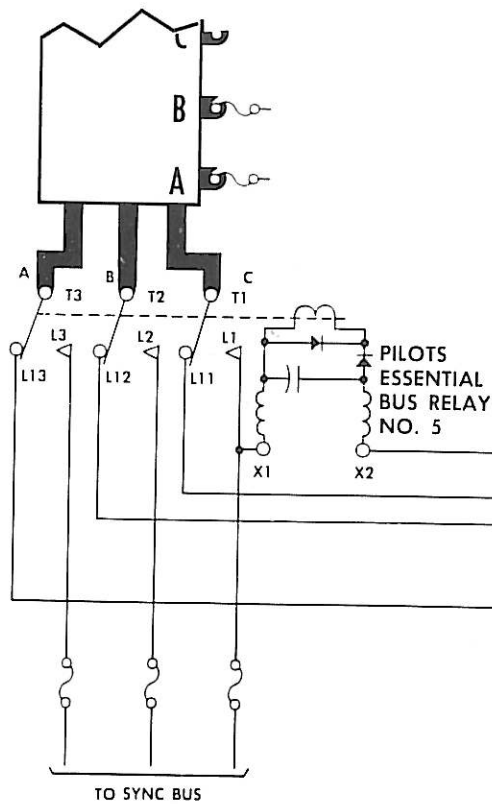
MAINTENANCE MANUAL

PILOTS ESSENTIAL BUS SELECTOR SWITCH

EFFECTIVITY
APPLICABLE TO AIRPLANES
CV1 THROUGH CV25

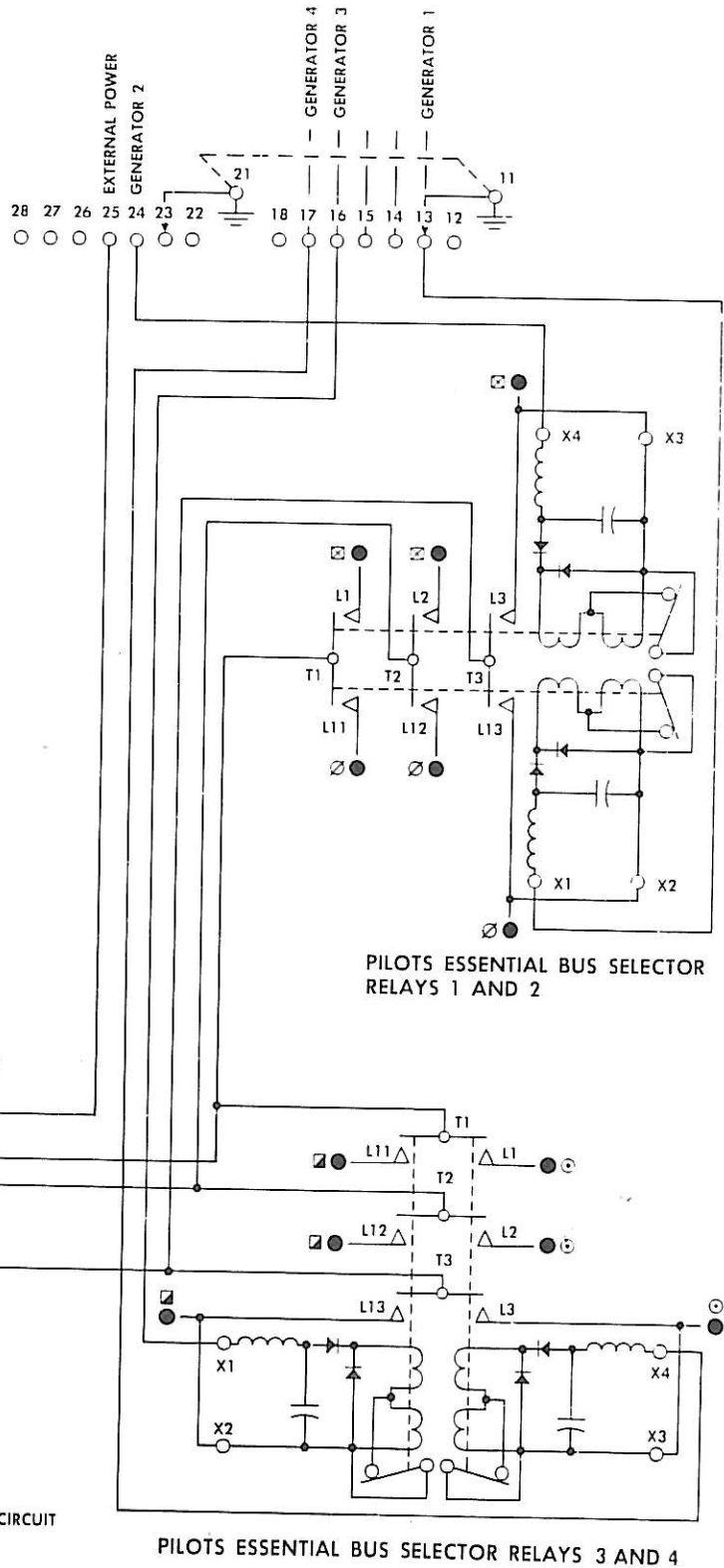
NOTE:
REFER TO WIRING DIAGRAM MANUAL FOR
FUSE AND CIRCUIT BREAKER AMPERAGES.

PILOT'S AC ESSENTIAL BUS (REF)



NOTE:
● INDICATES-TO AC POWER CIRCUIT
○ GENERATOR 1
□ GENERATOR 2
■ GENERATOR 3
⊙ GENERATOR 4

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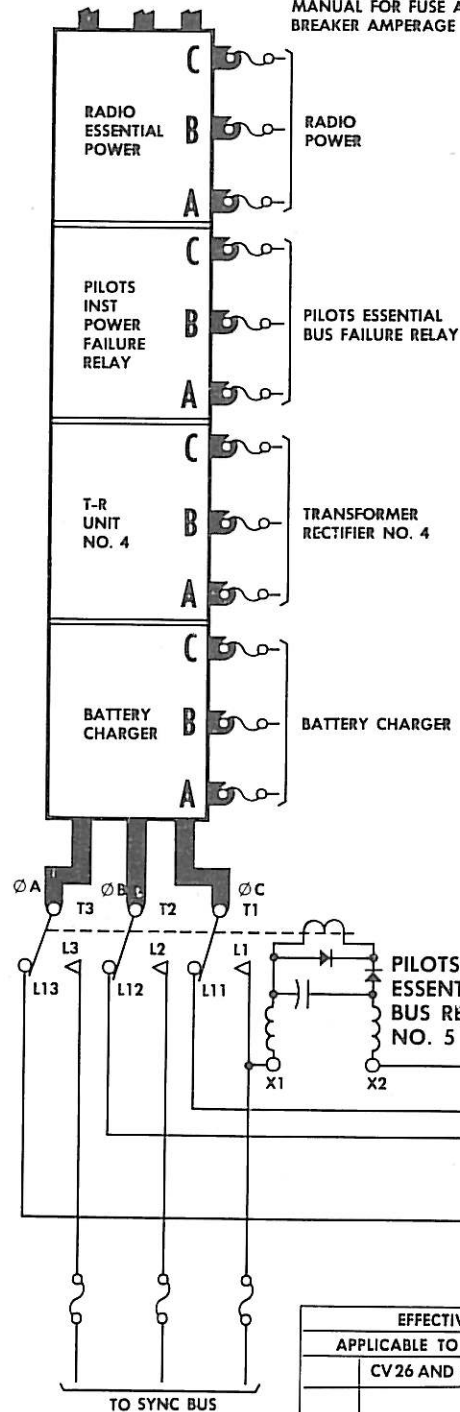
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AC Power Distribution System
Figure 3 (Sheet 17 of 18)

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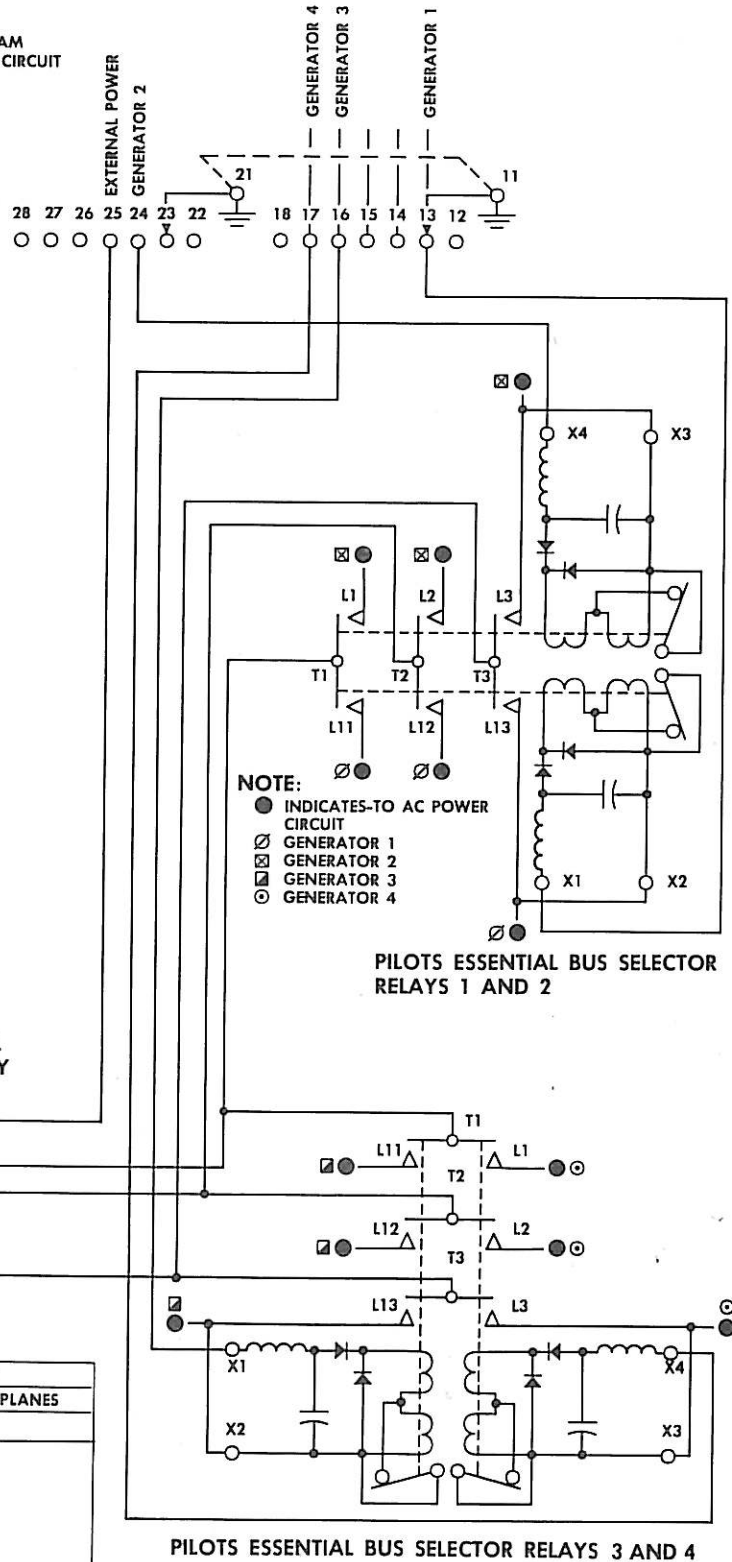
PILOT'S AC ESSENTIAL BUS

SEE SHEET 16
FOR CONTINUATION
OF PILOT'S ESS BUS



NOTE:
REFER TO WIRING DIAGRAM
MANUAL FOR FUSE AND CIRCUIT
BREAKER AMPERAGE

PILOTS' ESSENTIAL BUS SELECTOR SWITCH



EFFECTIVITY
APPLICABLE TO AIRPLANES
CV26 AND ON

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by placing the associated load reduction switch on the ac control panel in the OFF position. The switches enable the flight engineer to disconnect all nonessential circuits if a reduction in electrical loads becomes necessary.

A. Parallel Operation.

During Parallel operation of the ac power supply system, automatic connection between the generator output feeders and the essential buses is made through the generator line and bus tie contactors. All buses are powered by the combined output of all generators, via the sync bus, after the paralleling operation is completed. The pilots' ac essential bus normally receives power from any operating generator; however, placing the pilots' ac essential bus selector switch in the EXT PWR position connects it to the output of all paralleled generators on the sync bus. When any generator position (GEN No. 1, No. 2, No. 3, or No. 4) is selected, the ground circuit for one of the pilots' essential bus relays is completed to close its normally open contacts. One side of the relays connect directly to the generator feeder lines and the other side to the pilots' bus, via the sync bus relay's normally closed contacts.

B. Isolated Operation.

During isolated operation, generator output routes through the closed contacts of the generator line contactor and then to the buses. (The bus tie contactors are automatically held open during isolated generator operation.) Each generator connects to an associated load bus, i.e., No. 1 generator to the No. 1 nonessential ac bus, No. 2 generator to the No. 2 essential ac bus, etc. The pilots' ac essential bus is powered by the generator position selected by the selector switch.

C. External Power Operation.

When the airplane is on the ground and electrical power is being supplied by an external ac power unit, all load buses receive power from the sync bus, through the bus tie contactors. The bus tie contactors are energized by the dc power derived from the external power T-R unit through contacts of the tie control transfer relay.

D. 28-volt AC Power Distribution.

A 115-volt power feeder line connects directly to an external power line to provide lighting for ground maintenance. (Other distribution buses need not be energized at this time.) Power is available for these circuits whenever the external power unit is connected to the airplane and is delivering the proper output. The 115-volt feeder line connects directly to the ground maintenance relay contacts.

This relay is energized by power derived from the external power contactor. When the ground maintenance relay is energized, the 115-volt power routes to the essential lighting transformer. This is a stepdown transformer whose output voltage connects to the circuit breakers for operation of the light circuits.

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When the airplane's main distribution buses are energized, power to operate the lights is obtained from the No. 3 essential ac bus. This power is available when the external power switch is placed in the ON position. This switch action indirectly controls the power required to energize the ground maintenance relay. Deenergizing the relay opens the contacts feeding power from the external power unit to the lighting transformer and closes the contacts that connect this transformer input to the No. 3 essential ac bus.

E. 26-volt Instrument Power Distribution.

The 26-volt ac power required for certain airplane instrument systems is derived from two 115/26-volt ac, stepdown transformers. One transformer is all that is required to supply the necessary power. The MAIN transformer is powered by the No. 3 essential ac bus and is normally used for operation. The main transformer output routes to the open contacts of the instrument power transfer relay to energize the coil of the standby instrument transformer indicator relay. A two-position control switch labeled MAIN-STANDBY controls the source from which the 26-volt ac instruments are powered. Two indicator lights (MAIN OUT and STANDBY OUT) visually warn the flight engineer that the associated transformer power has been cut off.

F. Ground Maintenance Relay Power Distribution.

Power is supplied to the following circuits when an external ac power unit is connected to the MAIN external power receptacle and the external power control switch is in the OFF position:

- Cabin General Lights
- Utility Receptacles
- Aft Cargo Compartment and Tail Cone Lights
- Forward Cargo Compartment Lights
- Lavatory Occupied Warn Lights
- Electrical and Electronic Compartment Lights
- Map Reading Lights
- Air Conditioning Compartment Lights
- Forward and Aft Stewardess Panel Lights
- Forward and Aft Passenger Entrance Lights
- Forward and Aft Buffet Lights
- Flight Compartment Dome Lights
- LH, RH and Center Refuel Valves
- Passenger Warning Signs
- Circuit Breaker Panel Lights
- Wing Ice Lights
- Wheel Well Lights
- Oil and Fuel Quantity Indicators

G. Nose Tow Power Distribution System.

(Applicable to airplanes equipped with a nose tow power receptacle)

The nose tow power system furnishes power for the following systems while the aircraft is being towed:

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Anti Collision Lights
Cabin General Lights
Flight Compartment Dome Lights
Position Lights

VHF Communications No. 2
Auxiliary Hydraulic Pump
Audio Selector Panel(s)
Refuel Valves

4. Generators (see Figure 4)

The generators are the heart of the power supply systems and all other components in the system function to transmit, control and protect the generator output. Basically speaking, a generator is an electromechanical device that converts mechanical energy to electrical power. Each eight-pole generator comprises a stator that consists of a series of fixed coils from which power is taken, a rotor that consists of a series of rotating electromagnets and which is referred to as the field winding, and various mechanical parts such as a shaft, end punchings, bearing and a frame. Each generator weighs approximately 77 pounds.

A. Rating. Each of the four generators rate as follows:

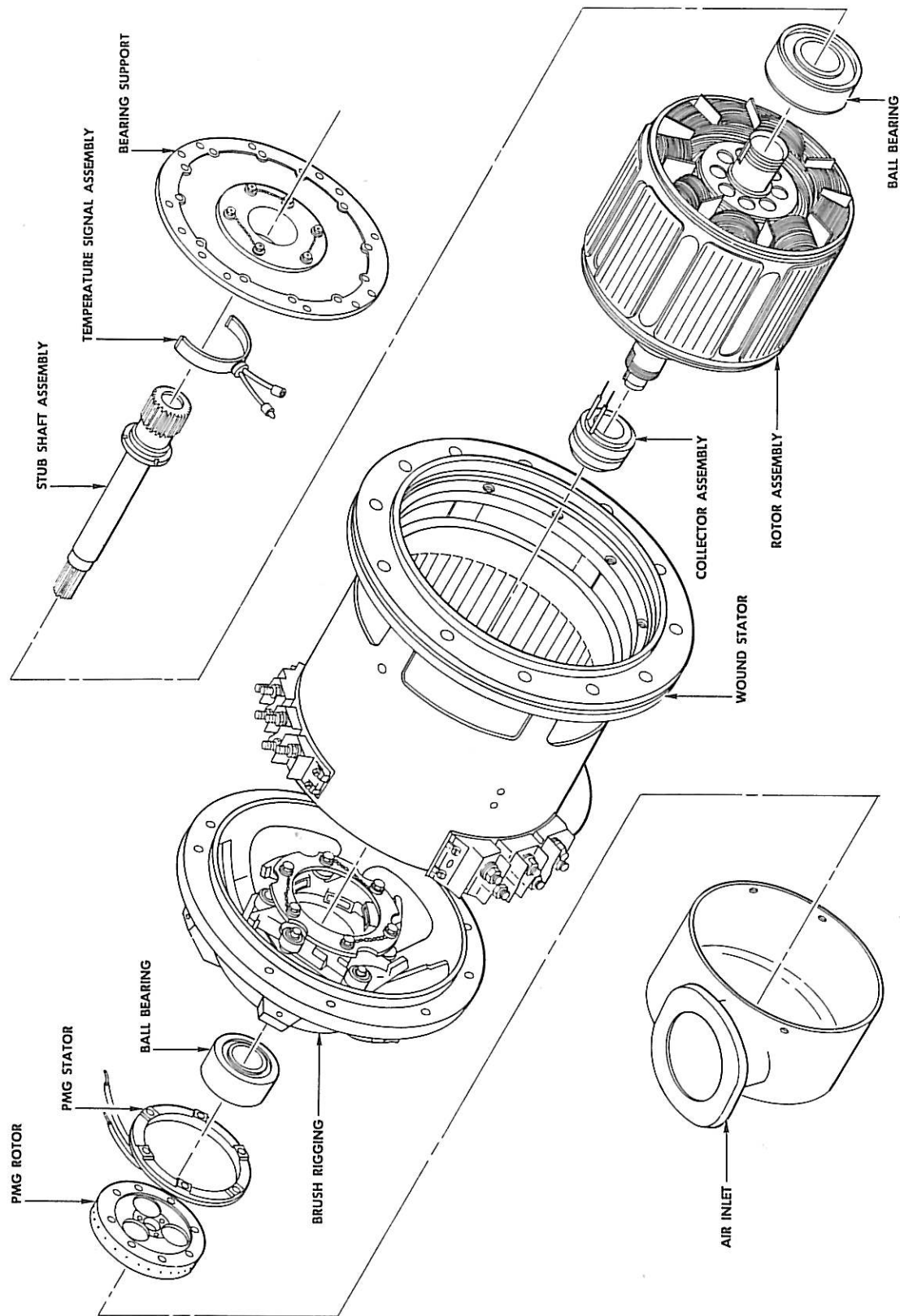
Rated Power	40 KVA
Rated Voltage	120/208 volts
Power Factor	1.0 to 0.27 lag
Frequency	400 cps
Efficiency at Full Load	85 percent
Weight	77 pounds
Size:	
Diameter.....	9 inches
Length.....	12 inches

The generator will supply 150 percent of its rated load for five minutes and 200 percent of its rated load for five seconds at a certain cooling air factor. The short-circuit capacity of a single generator system is 333 amperes for a minimum of 5 seconds, when subjected to a 3-phase, line-to-neutral short circuit (111 amperes per phase). A generator system will supply 388 amperes for 10 seconds when subjected to a single phase line-to-neutral fault.

B. Generator Cooling. The heaviest loads imposed on a generator are during ground operation, therefore a special paddle-type fan blade is an integral part of the wedges holding the rotor coils in place. The generators operate self-ventilated, at full load, from 0 to 7000 feet of altitude with a cooling air temperature of 86 degrees F (30 degrees C). Cooling ducts provide blast air for ventilation in flight.

Temperature signal assemblies located on the bearing support, and the stator are wired in parallel to sense the temperature of the generator bearing and stator, respectively. A red, overheat, warning light on the flight engineer's control panel illuminates when an overtemperature condition is sensed by either temperature signal assembly. Access to any generator is made through the clam shell type cowl doors on each engine pod.

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- C. Permanent Magnet Generator. A permanent magnet generator (PMG) is incorporated within the generator housing, and is mounted on the same shaft as the field winding. The generator is single-phase. It consists of a rotor made up of 32 permanent magnets mounted in a pancake-type support, and a stator consisting of a dish-type winding supported by the generator housing. An axial air gap separating the rotor and stator can be adjusted by increasing or decreasing the number of shims. Because of this air gap, the rotor and stator alignment is not critical. The PMG, rotating at 6000-rpm, produces a frequency of 1600-cps, which is supplied to the voltage regulator and other protective devices. The advantages of using 1600-cps frequency are: improved performance, greater output and a reduction in size of the generator. Load disturbances on the main ac systems have no effect on control functions because the PMG provides all control power independent of an external source. Besides ac control sensing, the PMG initiates generator action by providing flashing power for the generator system buildup, via a stepdown autotransformer, whose rectified output is approximately 28-volts dc.

PMG Ratings are:

Rated Power	250 watts
Rated Voltage	55 (± 3) volts ac
Frequency	1600 cps

5. Static Exciters (see Figure 5)

A static exciter is provided for each generator system. These units mount in pairs on the rear spar of each wing trailing edge. Access is possible through an access door in the wing trailing edge.

The static exciter eliminates the need for a rotating exciter to supply generator field excitation. It supplies excitation by combining a current and a voltage feedback from the generator output. With the exciter connected to the output side of the generator, a load current signal and a voltage signal appearing at the generator terminals are applied to the primaries of the saturable-current potential transformer. The voltage signal is then stepped down through transformer action and appears across the rectifier winding. This portion of the generator output is rectified and fed back to the generator field to satisfy the dc excitation needs.

- A. Operation. With no load on the system and with the generator rotating at rated speed, some dc power is fed from the permanent magnet generator transformer-rectifier directly to the generator field for flashing. This flashing power establishes a flux in the main field, resulting in some generator terminal voltage. This voltage appears across the winding of the saturable-current potential transformer, causing a small current to flow. This primary current causes a current flow in the rectifier winding. The rectified output is fed back to the generator field causing the generator terminal voltage to pyramid.

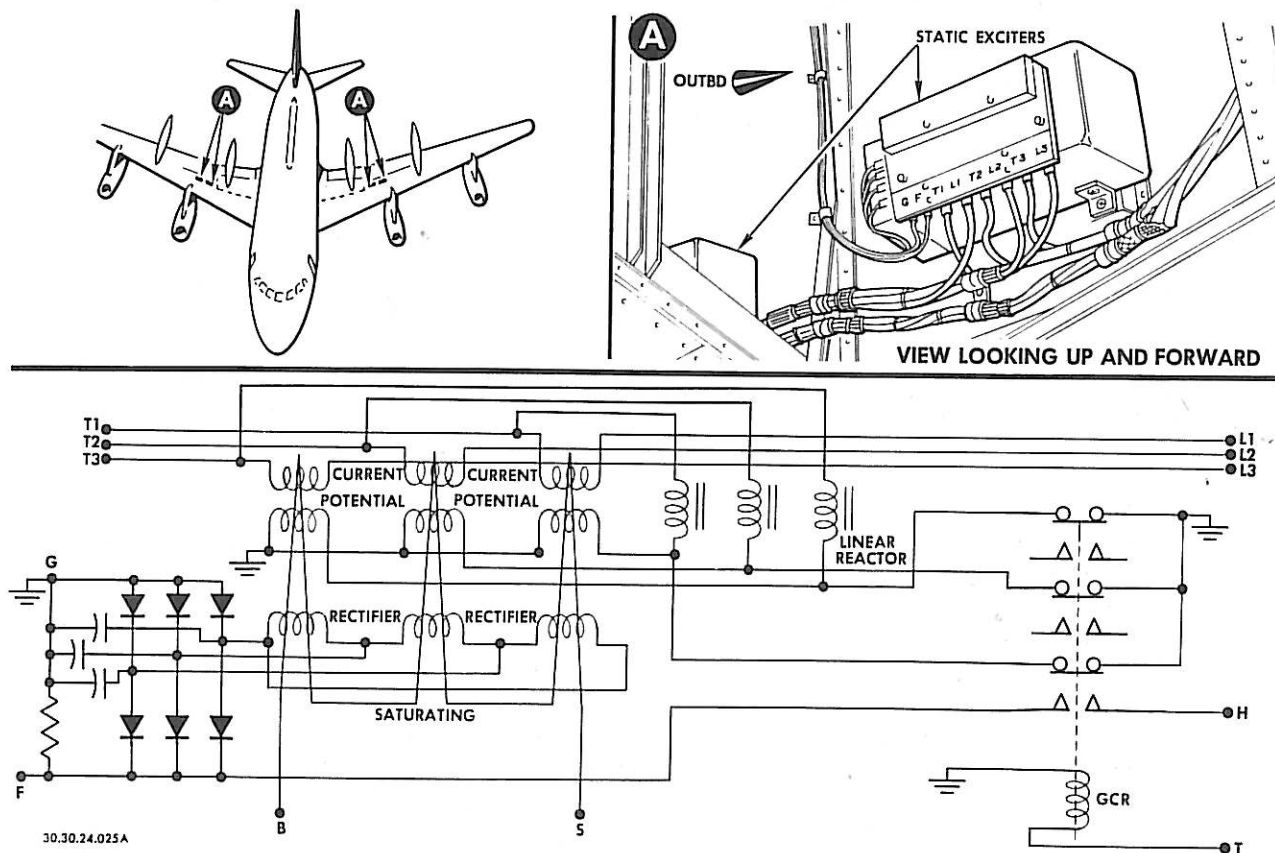
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When a load is applied, the generator terminal voltage is routed to the load through the current winding of the saturable-current potential transformer. This generator terminal voltage causes current to flow through the current winding and then through the load, and is limited only by the value of load impedance.

6. Controller-Regulator

The controller-regulator unit for each ac generator system mounts in the electrical compartment racks. Access to the units for maintenance purposes is made through the external access door of the electrical/electronic compartment. Inflight access is made through the access door located in the floor of the forward coat closet. The controller-regulator contains the voltage regulator, reactive biasing circuit, control and protective circuitry, and the ac switching circuits.

- A. Voltage Regulator Circuit. The voltage regulator circuit (see Figure 6) furnishes a dc voltage to the saturating windings of the saturable-current potential transformer in the static exciter, thereby maintaining a constant voltage output at the generator terminals. It is imperative that the line voltage remain as near constant as possible. The electrical equipment on the airplane operates inefficiently if the voltage drops, and the equipment may burn out if the voltage rises too



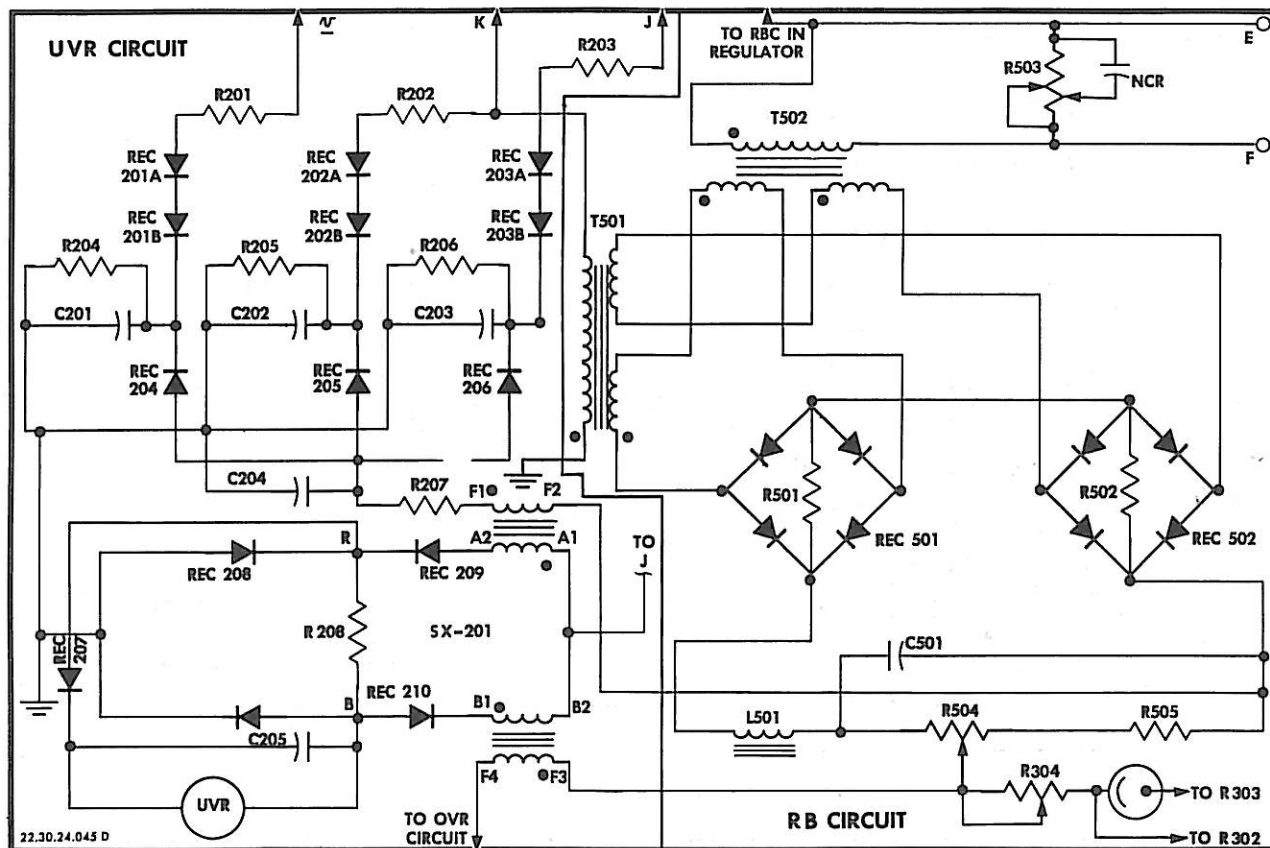


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high. The voltage regulator maintains a preset voltage level under all loading conditions. It does this by sensing the line voltages, comparing any changes that occur with a preset reference, and developing an error signal to correct the generator field excitation thereby restoring the terminal voltage to the desired level.

B. Reactive Biasing. To obtain optimum performance during parallel operation, the load current is divided equally among all the generators on the sync bus. During parallel operation, the generator line and bus tie contactors energize and the primary of a current transformer is brought into the circuit. If all paralleled generators supply their share of the total load, the currents in the loop are all equal. If a system disturbance, such as a parallel transient, should occur on generator system No. 1 so that it supplies 120 amperes, and generator systems No. 2, 3, and 4 supply 80 amperes each, the circulating current in the loop is proportional to the average (90 amperes). The current in the No. 1 generator system produces a signal to decrease excitation so that the system supplies 90 amperes. The current into the other paralleled generator systems produces a signal in each system to increase the excitation so that they supply 90 amperes.

C. Undervoltage Protection. The undervoltage relay circuit (see Figure 7) provides system protection from sustained undervoltage resulting from

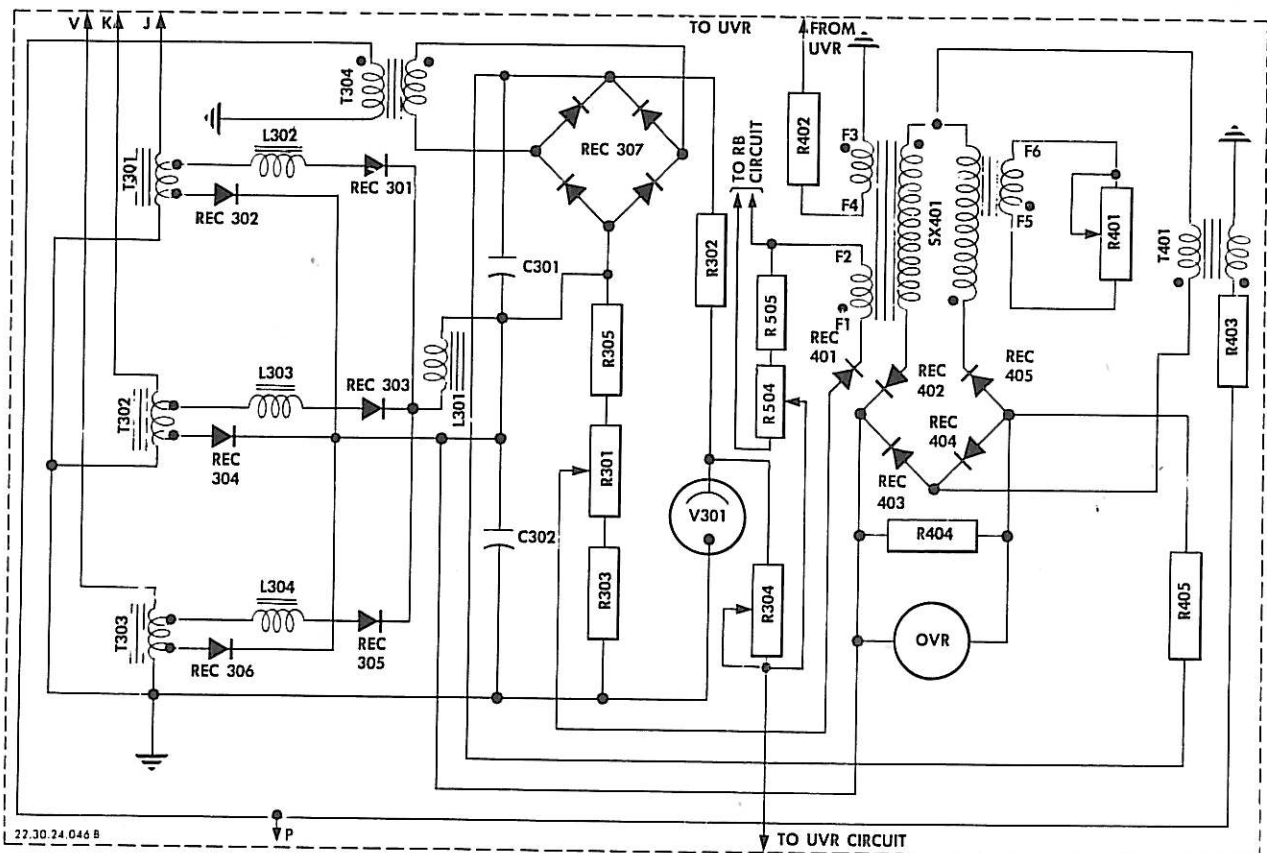


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underexcitation, generator faults or faults on the load bus. This is done by sensing each phase and rectifying the voltage to provide a dc signal proportional to the phase-to-neutral voltage. The rectifier voltage is compared with the reference voltage and the resultant error signal controls the undervoltage relay.

- D. Overvoltage Protection. The overvoltage relay circuit (see Figure 8) provides system protection from sustained overvoltage resulting from overexcitation, and generator faults. This is done by sensing the average of the three, phase-voltages, and comparing this average with a reference voltage. The resultant error signal controls the overvoltage relay.
- E. Unbalanced Current Protection. The unbalanced current relay circuit (see Figure 9) senses and protects against a loss of real load division by the constant speed drives. This is the only backup protection against the drive governor and is effective during parallel operation. Loss of real load division forces isolation of the faulty generator system in a parallel operation.

After the unbalanced current relay operates to isolate the faulty system, the systems protective circuitry deenergizes the generator as if it were operating isolated.

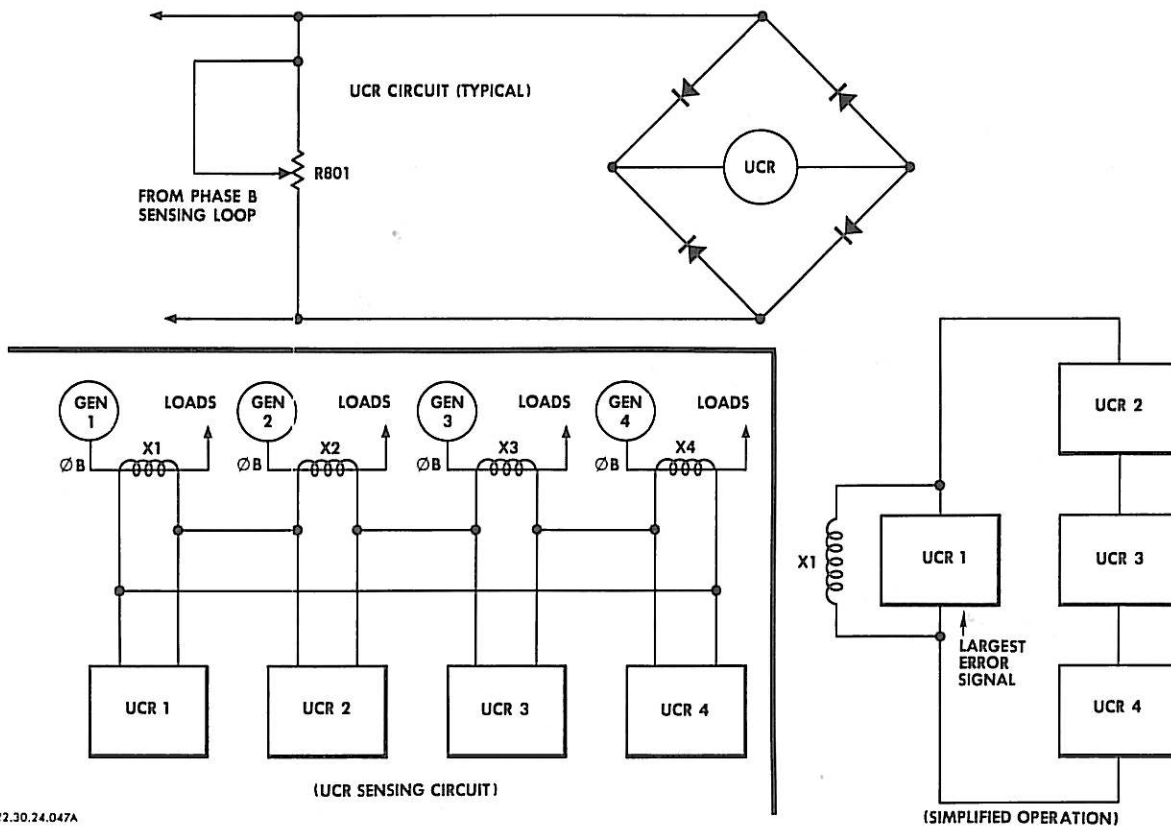


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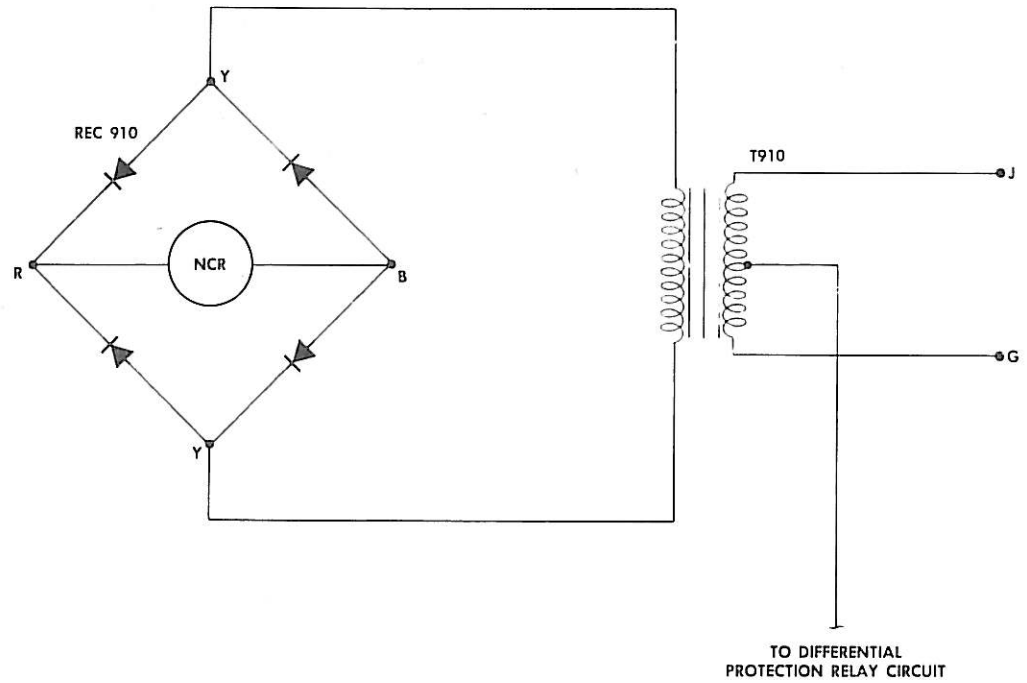
- F. Neutral Current Protection. The neutral current sensing circuit (see Figure 10) detects a system open phase, and detects line to ground or line-to-line-to-ground faults during parallel operation. During an open phase condition, a current is produced in the full wave rectifier bridge and energizes the neutral current relay. The neutral current relay circuit reduces the effect of reactive biasing in the normal generating system to prevent false tripping, and isolates one or more generator systems from parallel operation.

The neutral current relay circuit also senses line-to-ground or line-to-ground feeder faults. The instantaneous trip operation of the differential protection relay overrides the operation of the delayed neutral current trip, and no system isolation results.

- G. Automatic Paralleling Relay Circuit. The automatic paralleling relay circuit (see Figure 11) connects each generator system to the sync bus at the proper time to minimize system disturbances. The automatic paralleling relay (APR) operates and synchronizes the generator systems when they are within close frequency limits. Generator frequency is controlled by the governor in the constant speed drive. The first step in synchronizing the generator systems is connecting one system to the sync bus. Once this is done, the remaining generator systems automatically connect to the bus through the automatic paralleling relay and sequence switching circuits.

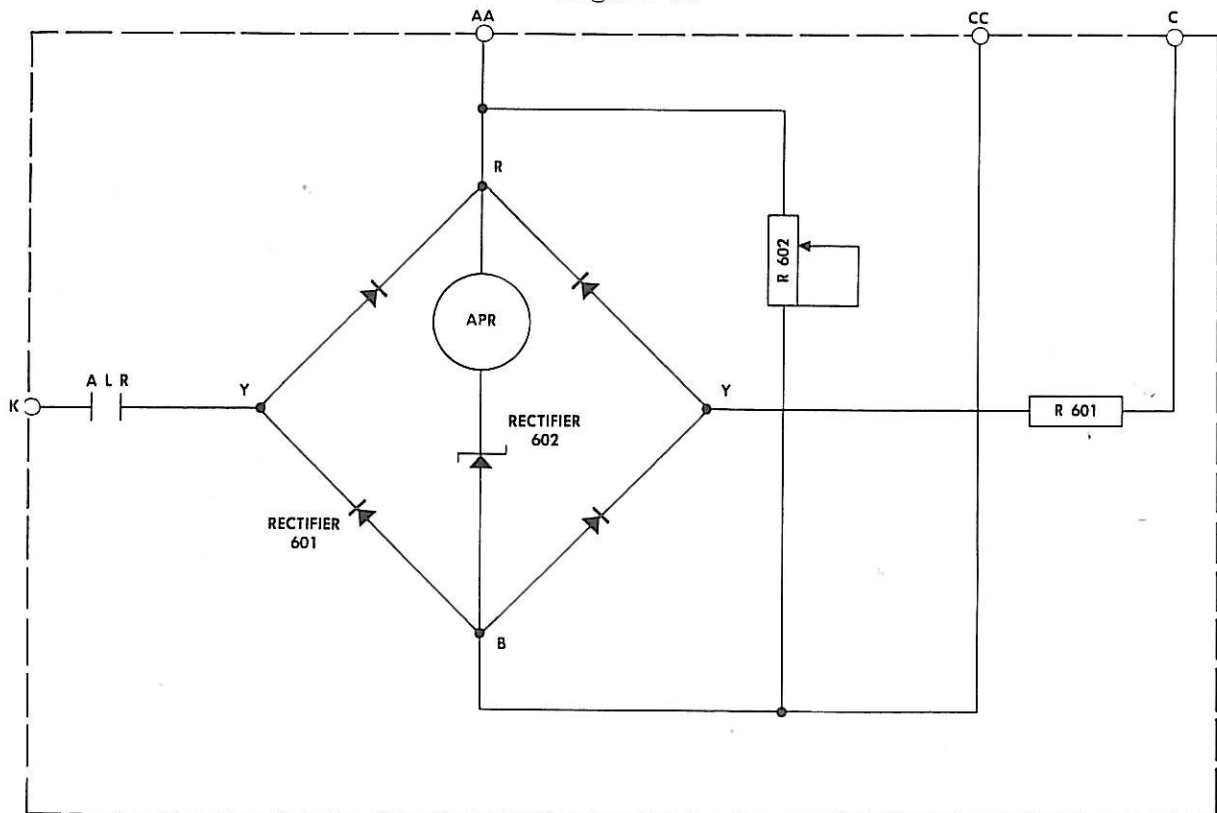


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Neutral Current Relay Circuit
Figure 10



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H. Differential Protection. The differential protection circuit detects feeder faults and deenergizes a malfunctioning generator system. A typical generator differential protection relay circuit is shown in Figure 12. The current transformers in the circuit compare the current flowing in the ground leg of each phase of the generator windings with the current flowing out of the corresponding feeder wire at the generator line contactor. This is done in all three phases of each generator system. If the currents in each transformer differ by more than a specified value, the differential protection relay circuit deenergizes the generator system.

7. Sync Bus Protection Panel (see Figure 13)

The ac system incorporates a sync bus protection unit to protect against faults that may occur on the sync bus. The unit is located on the aft face of the electric rack in the electrical compartment. Flight access to the unit is through the access door in the floor of the forward coat closet. Ground access for maintenance is through the electrical/electronic compartment access door at the airplane centerline.

The unit protects the sync bus against line-to-line and 3-phase line-to-ground faults. When a line-to-line or line-to-ground fault appears on the sync bus, one or more of the phase-voltages is lower than the unit's internal reference voltage. This causes a relay to deenergize splitting the system and all four generators return to isolated operation.

8. Real Load Division

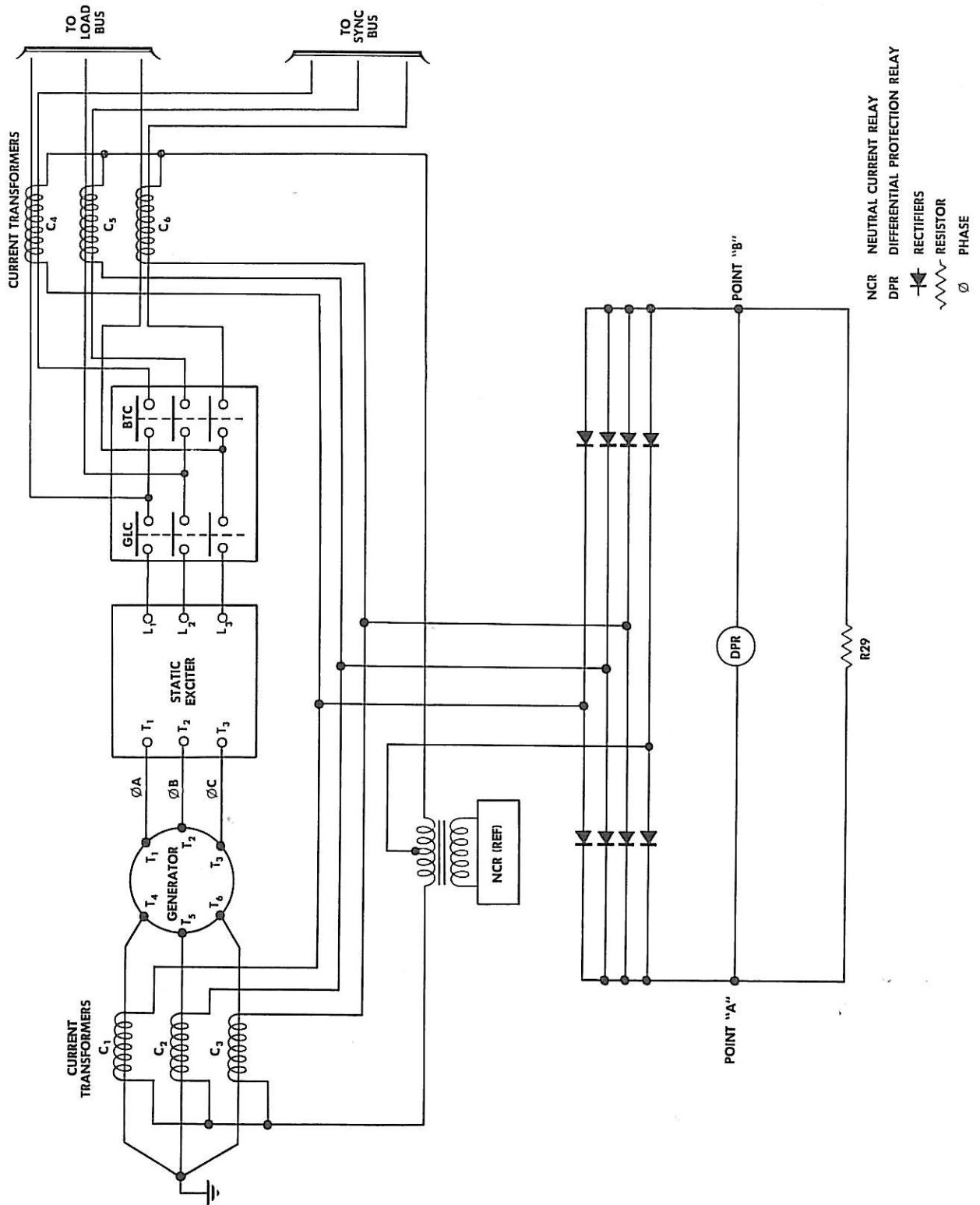
The real load division control consists of a current transformer assembly for each generating system, a load controller unit which signals the load division biasing solenoid in the constant speed drive, and all the circuitry necessary to complete the equalizing loop. The system acts differentially to balance output torque; that is, it tends to reduce the torque of the CSD carrying an insufficient load.

During normal operation, the difference of the real load being supplied by each generator in parallel and the mean parallel load is sensed by the real load equalizer loop. The difference appears across a current transformer load resistor, located in the load controller, as a phase amplitude signal. The output of the load controller signals the load biasing solenoid in the CSD to balance the load equally among the generators. If one generator in the system is not paralleled, a shorting contact in the current transformer is closed and that drive acts as an isolated unit. The remaining drives in parallel are completely unaffected.

9. Instruments (see Figure 14)

The ac system instruments monitor the ac system during flight and ground maintenance checks. These instruments and other units associated with ac electrical power, are located on the flight engineer's ac control panel. The following subparagraphs give a brief description of the ac instruments:

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Differential Protection Relay Circuit
Figure 12

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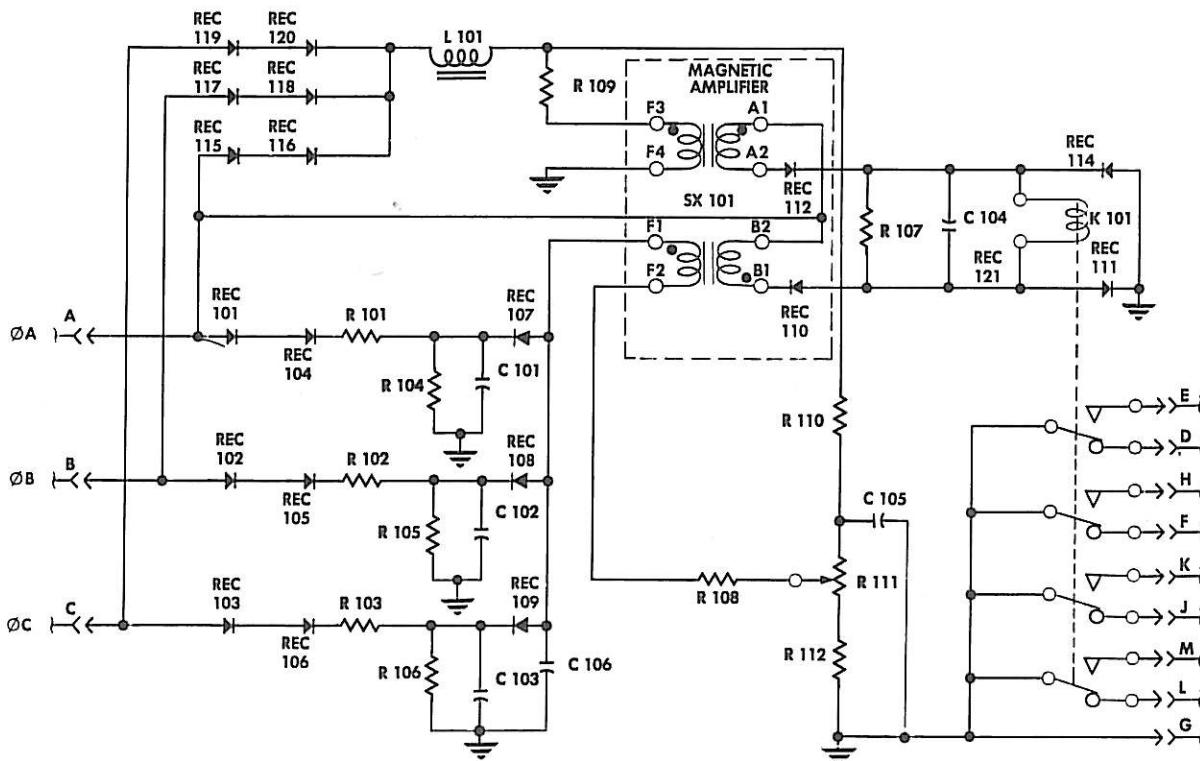
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- A. The ac voltmeter provides visual indication of generator or sync bus voltages. These voltage readings are obtained by turning a rotary selector switch adjacent to the meter. Voltage readings are from the phase B circuit in the generator or bus system selected.
- B. A frequency meter, connected in parallel with the voltmeter, gives simultaneous indication of cycles per second with a selection of any generator or bus voltage.
- C. Four ac ammeters, one for each generator system, provide a visual indication of the load being carried by the associated generator system.
- D. Four KW-KVAR meters, one for each generator system, provide visual indication of either KWATTS or KVARs. A single selector switch provides the desired reading on all four meters when placed in either the KW or KVAR position.

For removal/installation procedure for the ac system instruments, refer to Chapter 31, INSTRUMENTS.

10. Manual Control Switches

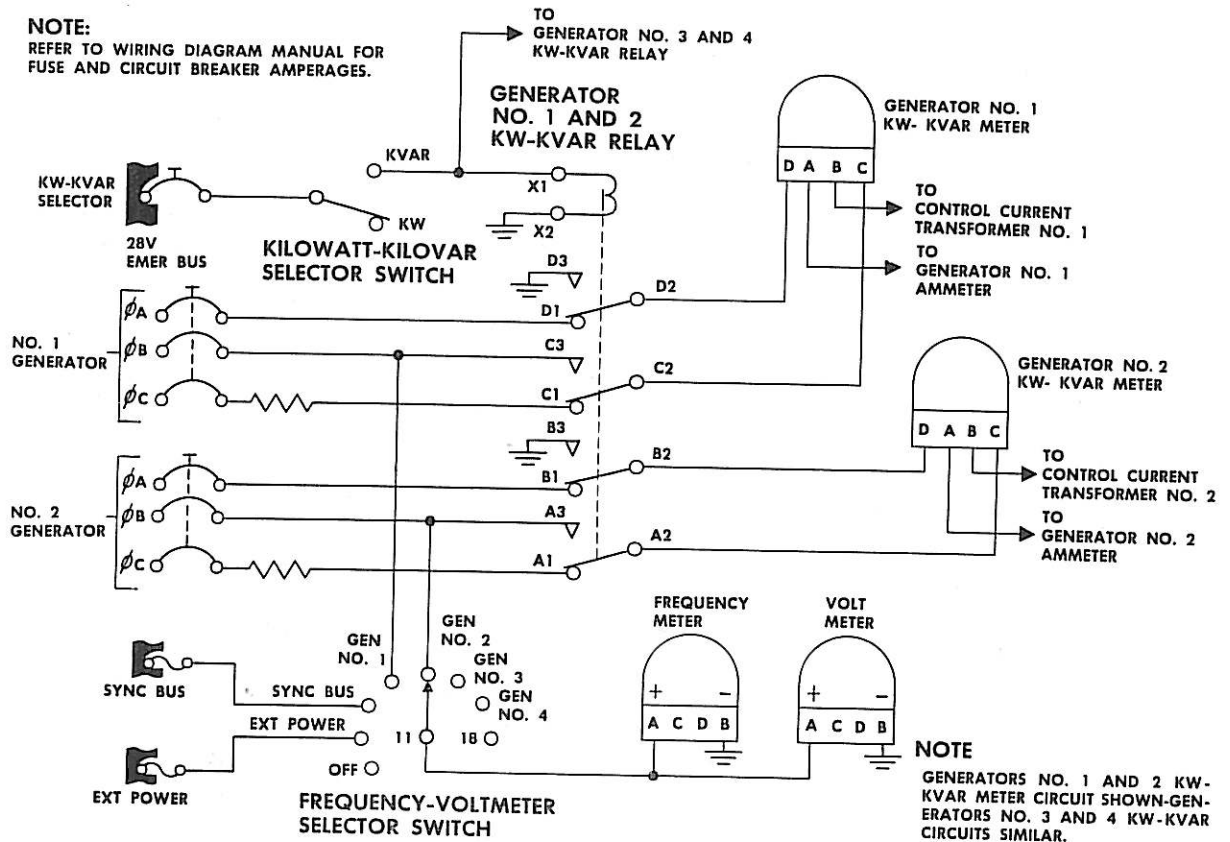
Switches for manual control of ac power are incorporated on the flight engineer's ac control panel (see Figure 2, Section 24-2-0) to assure control of the system should a malfunction develop in the automatic controls.



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One switch, for selection of the pilot's ac essential bus power, is installed on the overhead switch panel. The following is a list of the manual control switches and the number in parenthesis the quantity:

External Power Switch (1)
Generator Control Switches (4)
Generator Line Contactor Control Switches (4)
Bus Tie Contactor Control Switches (4)
Load Reduction Control Switches (2)
26-Volt AC Power Control Selector Switch (1)
CSD Disconnect Switches (4)
Frequency/Voltmeter Selector Switch (1)
KW/KVAR Selector Switch (1)
Pilots' AC Essential Bus Selector Switch (1)

- A. External Power Control Switch. The external power control switch is a 3-position switch labeled ON - OFF - GEN PARALLEL. When external power is applied and phase rotation is proper, placing this switch in the magnetically-held ON position provides a ground for the main external power contactor coil allowing it to energize. When the contactor energizes a set of normally-open contacts are closed to provide a ground holding circuit for the switch coil and the main contactor coil. Other contacts allow 3-phase power to be routed to the sync bus. (It will also apply a dc voltage to the control unit from the emergency transformer-rectifier.) The GEN PARALLEL position is a spring-loaded, momentary contact which, when selected, automatically initiates generator paralleling action. Four indicator lights (two blue and two white) operate in conjunction with this switch, refer to paragraph 12.
- B. Generator Control Switches. A three-position generator control switch for each generator is labeled ON-OFF-TEST. In the ON position, generator flashing is initiated and the system builds up to normal voltage. The TEST position performs the same function, except that it does not allow loads to be connected to the generator output. The OFF position indirectly deenergizes the generator. The OFF position will reset the generator system after any malfunction causes the generator to deenergize. An amber indicator light, adjacent to each switch, operates in conjunction with it (refer to paragraph 12).
- C. Generator Line Contactor Control Switches. The generator line contactor control switch for each generator system is a two-position switch labeled OPEN-CLOSE. The CLOSE position connects the generator to its load only when the generator control switch is ON and the generator is functioning normally. In the OPEN position, the generators are isolated from their respective load bus. An amber indicator light, located adjacent to each switch, operates in conjunction with it (refer to paragraph 12).
- D. Bus Tie Contactor Control Switch. A two-position, bus tie contactor control switch for each generator system is labeled OPEN-CLOSE. The switch must be in the CLOSE position before its respective generator can be paralleled, or before external power can be connected to the

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load bus. Moving the switch from CLOSE to OPEN and back to CLOSE re-connects the load bus to the sync bus, if a malfunction of this generator causes isolated operation and results in the generator becoming deenergized. The bus tie contactor control switches have an associated indicator light to visually show contactor configuration (refer to paragraph 12).

- E. Load Reduction Control Switches. The load reduction control switches are two-position (ON-OFF) switches for disconnecting nonessential loads, if a malfunction occurs on the essential No. 2 or 3 generator, by opening the load reduction relays. Each switch has an associated warning light that operates from some of the auxiliary contacts on the relay. When the switch is placed in the OFF position, the contactors remain open. To reconnect the nonessential buses to the ac supply system, the switches must be returned to the ON position. The indicator lights are described in paragraph 12.
- F. 26-Volt AC Power Control Selector Switch. A two-position selector switch, labeled MAIN-STANDBY, enables the Flight Engineer to select the available 26-volt instrument power. A warning light at each switch position warns the operator that either the MAIN (amber) transformer is OUT or the STANDBY (red) transformer is OUT. The MAIN transformer receives 115-volt operating power from the No. 3 essential ac bus and the STANDBY transformer from the pilots' ac essential bus. In this way, 26-volt instrument power is available at all times. The normal position of the switch is MAIN, but in case the MAIN OUT light illuminates, the switch should be placed in the STANDBY position. Sequence of operation for the red and amber indicator lights is described in paragraph 12.
- G. CSD Disconnect Switches. The four CSD disconnect switches, covered by red switch guards, are located across the top of the ac control panel and each has two positions (NORMAL-DISC). Each switch controls a generator CSD unit (GEN No. 1, 2, 3, or 4). The switches enable the flight engineer to disconnect any CSD unit if a malfunction occurs. CSD malfunctions are detected by observing the red DRIVE MALFUNCTION lights adjacent to the disconnect switches. These switches are usually retained in the NORMAL position, by breakaway safety wire, to prevent inadvertent operation, because the disconnect assembly cannot be reset in flight. If a disconnect operation is required, the switch is placed in the DISC position. For a complete description of the CSD quick-disconnect assembly, refer to Section 24-1-0. Operation of the red disconnect lights is described in paragraph 12.
- H. Frequency/Voltmeter Selector Switch. The frequency/voltmeter selector is a rotary-type switch with seven selective positions (OFF, EXT PWR, SYNC BUS, GEN 1, GEN 2, GEN 3, and GEN 4). This switch and the associated instruments enable the flight engineer to make a visual check of the voltage and frequency, simultaneously, on one particular bus, generator, or external power supply. The switch is located in the lower left corner of the ac control panel.

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- I. KW/KVAR Selector Switch. The KW/KVAR selector switch enables the flight engineer to select the indicating function he desires in regard to ac system operation. Operation of the single selector switch either energizes or deenergizes the two KW/KVAR control relays. These relays act as electrical switches and to route the selected signals to the four meters. The KVAR switch position energizes the two relays and moving the switch to the KW position interrupts 28-volt power to the relay coils causing them to deenergize the relays.
- J. Pilots' AC Essential Bus Selector Switch. A rotary switch on the overhead switch panel is the only ac system function assigned to the pilots. The switch provides the pilots with optional selection of any one of five alternate power sources to energize their ac essential load bus. The switch positions are labeled in a clockwise direction as follows: OFF, GEN No. 1, GEN No. 2, EXT PWR, GEN No. 3, and GEN No. 4. During flight, the switch is normally at one of the generator positions; however, the pilots' ac essential load bus can receive power from the sync bus, if desired, by placing it at the EXT PWR position when the generators are operating in parallel. When any of the generator positions are selected, power is derived directly from the generator output feeder lines. During ground operation, when the external power system is supplying the load current and none of the engines are operating, the switch is placed in the EXT PWR position and all load buses are supplied operating power from the sync bus.

11. AC System Power Contactors

Power contactors are utilized in the ac system to connect or isolate the buses from their power source. All contactors are spring-loaded and held in the OFF position when control power is removed from the coil.

- A. Generator Line and Bus Tie Contactors. The generator line and bus tie contactors (see Figure 15) are encased in one unit, and have individual actuating coils. The generator line contactor (GLC) either connects or isolates the generator to or from its load bus. The bus tie contactor (BTC) either connects or isolates the load bus to or from the sync bus. The operation is normally automatic through relays in the controller-regulators, provided the respective contactor control switches are in the CLOSED position. The contactors can also be manually operated to the desired position by manipulation of the OPEN-CLOSE switches on the flight engineer's ac control panel, providing 28-volt dc control power is available. Each contactor has an associated amber light (adjacent to the control switch) to show when the contactors are OPEN (light illuminated) or CLOSED (light extinguished).
- B. Nonessential Bus Contactors. The two nonessential bus contactors provided in the ac system are utilized for load reduction. When the main contacts of the unit are closed, the nonessential circuits connect to the ac power source. Deenergizing the nonessential bus contactors is accomplished manually by placing the load reduction switches in the OFF position. This action disconnects the ac power source from the nonessential bus and routes power from the auxiliary contacts to illuminate the load reduction warning lights on the ac generator control panel to

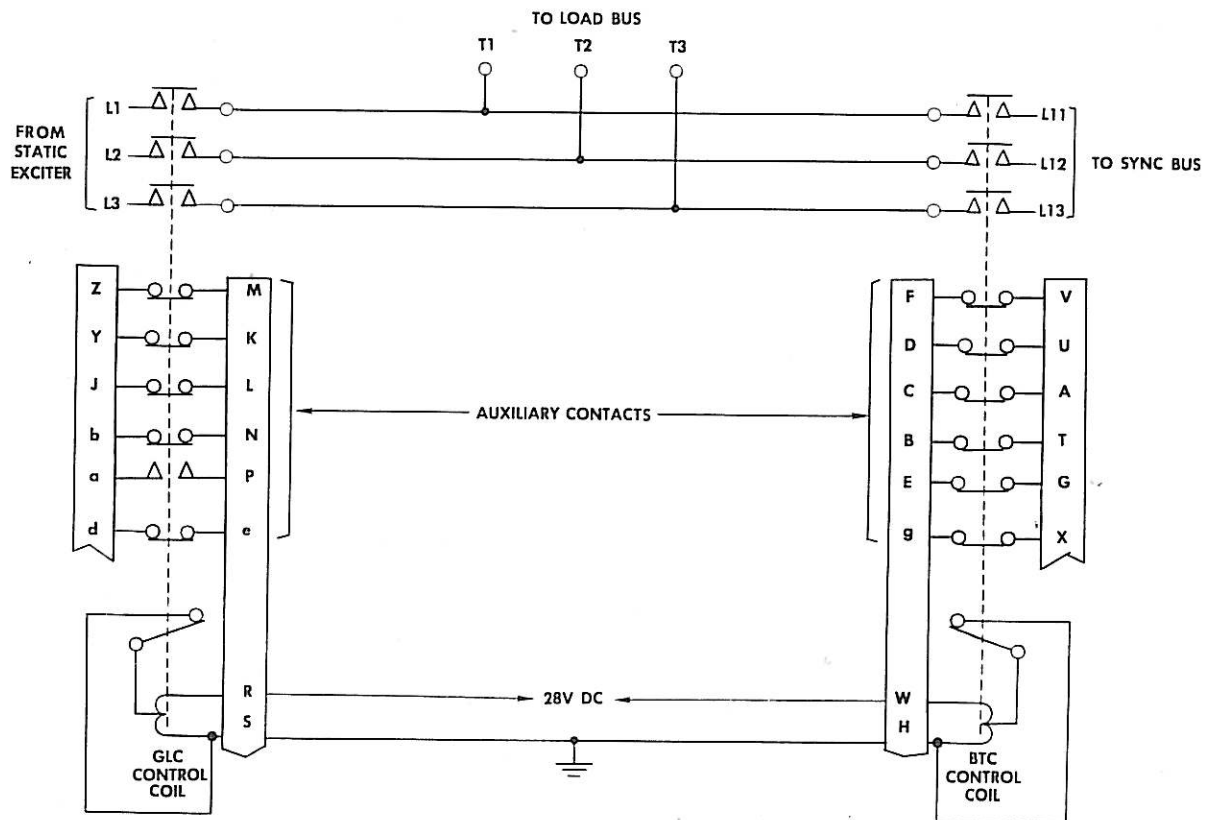
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show that the associated bus is deenergized. During operations using a ground external power unit, the nonessential bus contactors can only be closed when the auxiliary external power contactor is energized, because of an electrical interlock. This interlock feature protects the main external power receptacle from an electrical overload.

12. Warning Lights

The warning and indication lights in the ac power system, (see Figure 2) give a visual indication of a system malfunction or show the status of a component. The engraved, translucent bezel covering the bulbs indicates the function of the light, such as off, on, overheat, etc. Following is a list of the warning and indication lights incorporated on the flight engineer's control panel:

- Bus Tie Contactor Open Lights (4)
- Generator Line Contactor Open Lights (4)
- Generator Off and Overheat Lights (4 of each)
- 26-Volt AC Power Out Lights (2)
- CSD Drive Malfunction Lights (4)
- External Power On and Connected Lights (2 of each)
- Load Reduction Off Lights (2)



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- A. Bus Tie Contactor Open Lights. The amber bus tie contactor lights are adjacent to the bus tie contactor control switches on the ac control panel. The system circuitry is so arranged that when the bus tie contactors are opened, during automatic or manual operation, the amber CONT OPEN lights illuminate. Normally the light is extinguished, indicating that the bus tie contactor is closed; either sync bus power or generator output during parallel operation is supplying airplane electrical loads.
- B. Generator Line Contactor Open Lights. The four amber generator line contactor lights are adjacent to their respective generator line contactor switches on the ac control panel. The light circuits are electrically interconnected with other components in the ac system to indicate CONT OPEN whenever the generator line contactor is opened manually or automatically during ac system operation. Normally the generator line contactors are closed and the amber lights are extinguished.
- C. Generator Off and Overheat Lights. Two indicator lights adjacent to each generator control switch indicate whether the generator is inoperative or warn of an overheat condition.

The amber OFF light illuminates whenever the generator switch is placed in the OFF position or when the generator is automatically deenergized.

The red OVERHEAT light electrically connects to two thermal switches inside the generator housing. These switches are wired in parallel so that an overtemperature condition existing in either the stator windings or bearing support illuminates the affected generator's red OVERHEAT light.

- D. Load Reduction Off Lights. Two amber load reduction lights are incorporated on the upper portion of the ac control panel adjacent to their respective No. 1 and No. 4 nonessential ac bus load reduction switches. When the flight engineer elects to reduce the load on the ac generators, by placing either or both load reduction switches in the OFF position, the respective amber load reduction light illuminates (BUS No. 1 OFF or BUS No. 4 OFF). When both lights illuminate the No. 1 and No. 4 nonessential ac buses are deenergized.
- E. 26-Volt AC Power Out Lights. Two 26-volt ac power warning lights, one amber and one red, mount adjacent to the 26-volt ac MAIN-STANDBY selector switch on the upper portion of the ac control panel.

The ground circuit for the amber MAIN OUT light is interrupted by the normally closed contacts of the main instrument transformer indicator relay. These ground circuit relay contacts are open whenever 26-volt power is available from the main instrument transformer, because this transformer power energizes the relay coil. If output power from this transformer is interrupted for any reason, the relay deenergizes--completing the ground circuit and illuminating the MAIN OUT light. Illumination of the amber MAIN OUT light means the flight engineer should move the MAIN-STANDBY selector switch to the STANDBY position. This switch action routes power to actuate the instrument power

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transfer relay and allows the standby instrument transformer to power the 26-volt ac instrument bus. The switch has no effect on the operation of the lights, i.e., during the time the output of either transformer is interrupted, the applicable light remains illuminated. The red STANDBY OUT light operation is identical to the operation of the amber main light.

- F. Drive Malfunction Lights. The four red DRIVE MALFUNCTION lights are located adjacent to the associated CSD disconnect switches on the ac control panel. The ground circuit for each light connects to a thermal switch inside the CSD housing. The bimetallic contacts of these switches are sensitive to temperature. When a certain temperature is reached, the contacts close completing the ground circuit to illuminate the respective red DRIVE MALFUNCTION light. Illumination of any light is an indication that the flight engineer should initiate a disconnect procedure on the associated CSD system.
- G. External Power On and Connected Light. Refer to Section 24-3-0 for a detailed description of these lights.

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NORMAL AC POWER SYSTEM - TROUBLE SHOOTING

<u>POSSIBLE CAUSE</u>	<u>ISOLATION PROCEDURE AND CORRECTION</u>
1. <u>ONE GENERATOR SYSTEM CARRYING MORE THAN ITS SHARE OF THE TOTAL SYSTEM REAL LOAD</u>	
A. Faulty generator line or bus tie contactor.	Check for continuity through contacts Z and M, and F and V. There should be no continuity with the control coils energized. If continuity exists, replace contactor unit and check operation.
B. Faulty control transformer in load division loop or faulty loop wiring.	Check transformer and loop wiring. If faulty, repair or replace wiring or transformer.
C. Defective load controller.	(Refer to Section 24-1-1, Trouble Shooting.)
D. Defective wiring between load controller and drive.	Check for continuity between controller electrical plug and drive plug. If no continuity, repair or replace wiring and check operation.
2. <u>ONE GENERATOR SYSTEM CARRYING MORE THAN ITS SHARE OF THE TOTAL SYSTEM REACTIVE LOAD</u>	
A. Generator line and/or bus tie contactor faulty.	Check for continuity from contact U to D, and from contact Y to K. No continuity should exist with the coils energized. If continuity exists, replace contactor and check operation.
B. Control transformer in reactive load division loop or transformer loop wiring faulty.	Check transformer and loop wiring for continuity. If no continuity, repair or replace wiring; replace transformer and check operation.
C. Controller-regulator faulty.	Exchange suspected controller-regulator with one of the other system units. If reactive load malfunction shifts to other generator system, replace faulty unit and recheck operation.

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POSSIBLE CAUSEISOLATION PROCEDURE AND CORRECTION3. SYSTEM VOLTAGE DROPS WHEN LOAD IS APPLIED

- A. Open real and/or reactive loop or loops.

Check loop wiring and transformers for continuity. If no continuity repair or replace wiring, or replace transformer and check operation.

4. NO VOLTMETER OR FREQUENCY METER INDICATION ON ONE GENERATOR POSITION

- A. Generator deenergized.

Turn generator control switch to OFF and then back to ON and check operation.

- B. Open circuit breaker.

Check KVAR indication for same generator, if no reading check associated circuit breaker in phase B circuit of affected generator. If circuit breaker is open, close and recheck operation.

- C. Airplane wiring defective.

Check continuity of applicable wiring, if no continuity repair or replace wiring and check operation.

5. NO INDICATION ON KW/KVAR METERS WITH SELECTOR SWITCH IN KVAR POSITION

- A. Faulty KW/KVAR relay.

Check for 28 volts dc between pins X1 and X2 on suspected relay. If no power check continuity of wiring. If no continuity repair or replace wiring.

If power is present, replace relay and check system operation.

6. ESSENTIAL BUS FAILURE LIGHT ILLUMINATED WITH PILOT'S AC ESSENTIAL BUS SELECTOR SWITCH IN ANY OPERATING GENERATOR POSITION

- A. Faulty essential bus failure relay.

Check for continuity between A2 and A3 on relay with coil energized. If continuity exists, replace relay.

- B. Airplane wiring faulty.

Check for continuity in wiring between ground side of lights and essential bus failure relay, pin A3. If no continuity repair or replace wiring and check operation.

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POSSIBLE CAUSEISOLATION PROCEDURE AND CORRECTION

6. ESSENTIAL BUS FAILURE LIGHT ILLUMINATED WITH PILOT'S AC ESSENTIAL BUS SELECTOR SWITCH IN ANY OPERATING GENERATOR POSITION (CONT)
- | | |
|--|--|
| C. Open limiter at failure relay power source. | Check PILOTS' INSTR & FAILURE INDICATOR 5-ampere fuses (3) at pilots' ac essential bus. If limiter(s) is open, replace and check operation. |
| D. Faulty airplane wiring. | Check continuity of wiring between failure relay terminals L1, L2, and L3 and Phase A, B, and C respectively of pilots' ac essential bus. If no continuity, repair or replace and recheck operation. |
7. ESSENTIAL BUS FAILURE LIGHT DOES NOT ILLUMINATE WITH NO POWER ON PILOT'S AC ESSENTIAL BUS
- | | |
|----------------------------|--|
| A. Open circuit breaker. | Close AC INSTR POWER FAIL LTS circuit breaker and check operation. |
| B. Bulbs burned out. | Replace with bulbs of known quality and check operation. |
| C. Airplane wiring faulty. | Check continuity of wiring between circuit breaker and light. Then between light and failure relay. If no continuity repair or replace wiring and check operation. |
8. NO POWER ON THE NO. 1 OR 4 NONESSENTIAL AC BUSES, LOAD REDUCTION SWITCHES ON AND ASSOCIATED INDICATOR LIGHTS ILLUMINATED
- | | |
|---|--|
| A. Auxiliary power receptacle not plugged in. | Check auxiliary power receptacle and assure it is fully engaged with external ac power unit plug. |
| B. Faulty airplane wiring. | Check continuity of applicable wiring between external auxiliary power contactor, auxiliary power receptacle, auxiliary phase sequence relay, main contactor and main power receptacle. If no continuity repair or replace wiring and recheck operation. |
| C. Faulty auxiliary phase sequence relay. | Check that 28-volt dc power is present at pin A of auxiliary contactor with auxiliary phase sequence relay energized. If no power, replace relay. |

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POSSIBLE CAUSEISOLATION PROCEDURE AND CORRECTION

8. NO POWER ON THE NO. 1 OR 4 NONESSENTIAL AC BUSES, LOAD REDUCTION SWITCHES ON AND ASSOCIATED INDICATOR LIGHTS ILLUMINATED (CONT)
- D. Faulty auxiliary power contactor.
- If power is available at pin A (refer to step C) check for ground at pin B. If power and ground check good, replace auxiliary power contactor.
9. GENERATOR SYSTEM WILL NOT PARALLEL
- A. Low or high frequency.
- Check load controller, constant speed drive unit and then wiring between units. Replace faulty equipment or wiring as required and check operation.
- B. Bus tie contactor locked out.
- Check operation of parallel auxiliary relays 1 and 2, tie control transfer relay and control panel regulator. Replace faulty equipment as required and check operation.
- C. No paralleling signal.
- Check control panel regulator auto paralleling circuit, auxiliary contacts external power relay and interconnecting wiring. Replace faulty equipment or wiring as required and check operation.
- D. Bus tie contactor open or shorted.
- Check contactor coil. Replace faulty contactor and check operation.
10. GENERATOR SYSTEM ISOLATES AFTER SIX TO EIGHT SECONDS OF PARALLEL OPERATION
- A. Real load loop (KW and KVAR fluctuation).
- Check load controller, drive biasing coils, wiring between units, current transformers, and auxiliary contacts on bus tie and generator line contactors. Replace faulty equipment or wiring as required and check operation.
- B. Reactive load loop (KVAR fluctuations).
- Check control panel regulator, current transformers, auxiliary contacts on bus tie and generator line contactors, and wiring in current transformer loop. Replace faulty equipment or wiring as required and check operation.
- C. Neutral Current trip.
- Open feeder wire between generator and generator line contactor. Replace faulty wiring and check operation.

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- | <u>POSSIBLE CAUSE</u> | <u>ISOLATION PROCEDURE AND CORRECTION</u> |
|---|--|
| 11. <u>DURING PARALLEL OPERATION GENERATORS ISOLATE WITH LOAD OR SPEED CHANGES</u> | |
| A. Low oil level in drive oil tank. | Check oil tank level, drive magnetic plug, oil inlet line for kinks, and leaks in oil system tubing. Repair faulty equipment or service oil tank and check operation. |
| B. Sluggish response. | Check drive and load controller. Replace faulty equipment and check operation. |
| 12. <u>DURING PARALLEL OPERATION GENERATOR SYSTEM ISOLATES AND THEN DEENERGIZES</u> | |
| A. Faulted load. | Check power load fuses. Replace faulty fuses and check operation. |
| B. Faulty system. | Refer to paragraph 12 and 15. |
| 13. <u>DURING ISOLATED OPERATION GENERATOR SYSTEM WILL NOT CARRY LOAD</u> | |
| A. Low oil. | Check oil tank level, drive magnetic plug, leaks in oil system, and kinked oil lines. Service oil tank or repair or replace equipment as required and check operation. |
| B. Under excitation. | Check generator, static exciter and control panel regulator. Replace faulty equipment and check operation. |
| 14. <u>GENERATOR SYSTEM TRIPS OFF THE LINE IN FOUR TO SIX SECONDS OF ISOLATED OPERATION</u> | |
| A. Undervoltage. | Check controller regulator, static exciter, and airplane wiring between these units. Replace faulty equipment or wiring as required and check operation. |
| 15. <u>GENERATOR SYSTEM SELECTED FOR ISOLATED OPERATION TRIPS OFF THE LINE IMMEDIATELY</u> | |
| A. Overvoltage. | Check controller regulator, static exciter, and airplane wiring between these units. Replace faulty equipment or wiring as required and check operation. |
| B. Feeder line fault. | Check feeder line wiring, current transformers and controller regulator. Replace faulty wiring or equipment as required and check operation. |

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POSSIBLE CAUSEISOLATION PROCEDURE AND CORRECTION16. GENERATOR SYSTEM WILL NOT ENERGIZE FOR ISOLATED OPERATION

- | | |
|---|--|
| A. Disconnect system actuated. | Check drive. Reset disconnect system or replace drive as required and check system operation. |
| B. Underspeed switch. | Check continuity of underspeed switch and airplane wiring. Replace faulty drive or wiring as required and check operation. |
| C. Generator control relay. | Check static exciter. Replace faulty exciter and check operation. |
| D. No flashing voltage. | Check controller regulator. Replace faulty equipment and check operation. |
| E. Shorted or open field winding, low PMG voltage, or shorted stator. | Check generator. Replace faulty equipment and check operation. |

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NORMAL AC POWER SYSTEM - MAINTENANCE PRACTICES

1. Adjustment/Test Normal AC Power System

A. General.

Because the operation of the normal ac power system is virtually automatic, few procedural steps are required. However, proper system operation is determined by observing operation of the system warning lights. By manipulation of certain manual control switches and observing the indicator light operating sequence, proper system operation can be checked.

B. Equipment Required - External AC Power Unit.

C. Preparation.

- (1) Connect external ac power unit and energize all airplane load buses, (refer to 24-3-0, Adjustment/Test).
- (2) Check that the following manual control switches are in the positions indicated.
 - (a) Generator control switches No. 1, 2, 3, and 4 - ON.
 - (b) Generator line control switches No. 1, 2, 3, and 4 - CLOSE.
 - (c) Bus tie control switches No. 1, 2, 3, and 4 - CLOSE.
 - (d) Generator disconnect switches No. 1, 2, 3, and 4 - NORMAL.
 - (e) Bus No. 1 and 4 load reduction switches - NORMAL.
 - (f) Battery control switch - OFF.
 - (g) T-R control switches No. 1, 2, 3, and 4 - ON.
 - (h) 26-V AC power selector switch - MAIN.
 - (i) External power control switch - EXT PWR.
 - (j) KW/KVAR selector switch - KW.
 - (k) Frequency/Volt selector switch - EXT PWR.
 - (l) Pilots' ac essential bus selector switch - EXT PWR.
 - (m) Essential bus relay switch - NORMAL.

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- (3) Check that the following circuit breakers are closed:
- (a) GENERATOR AC POWER CONTROL 1, 2, 3, and 4.
 - (b) KW/KVAR SEL.
 - (c) GEN AC SYS IND LTS - 2, 3, 1, and 4.
 - (d) BAT CHGR CONT.
 - (e) INST AC PWR FAIL LTS.
 - (f) 26V AC INST BUS CONT.
 - (g) CSD WARN 1, 2, 3, and 4.
 - (h) CSD CONTROL 1, 2, 3, and 4.
 - (i) 26V AC LTG TRANS CONT.
 - (j) MASTER WARN CONT & A.P. OFF
 - (k) MASTER WARN.
- (4) Check that the following system warning lights show the configuration indicated:
- (a) GEN OVERHEAT lights - extinguished.
 - (b) GEN OFF lights - illuminated.
 - (c) Generator line CONT OPEN lights - illuminated.
 - (d) Bus tie CONT OPEN lights - extinguished.
 - (e) DRIVE MALFUNC lights - extinguished.
 - (f) Bus 1 and 4 load reduction OFF lights - extinguished.
 - (g) 26V ac MAIN OUT and STANDBY OUT power lights - extinguished.
 - (h) External power AUX-MAIN CONN and AUX-MAIN ON BUS lights - illuminated.
 - (i) ESSENTIAL BUS FAIL light - extinguished.
 - (j) INSTR BUS FAIL light - extinguished.
 - (k) BATTERY CHARGER RELAY OPEN light - extinguished.

D. Test Normal AC Power System.

- (1) Start one engine (refer to Chapter 71, POWER PLANT- GENERAL).
- (2) Check the following warning lights related to the operating engine for the configuration indicated - after engine reaches idling speed.

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- (a) Generator OFF light - extinguished.
 - (b) Bus tie CONT OPEN light - illuminated.
 - (c) Generator line CONT OPEN - extinguished.
- (3) Applicable KW meter shall show indication.
- (4) Turn Frequency/Volt selector switch to applicable generator position.
- (a) Voltmeter shall indicate 115 (± 2.0) volts.
 - (b) Frequency meter shall indicate 400 (± 4.0) cps.
- (5) Place pilots' ac essential bus selector switch in operating generator position. ESSENTIAL BUS FAIL light shall remain extinguished.
- (6) Repeat steps (1) through (5) for each engine generator system. Results shall be the same for each.
- (7) When all generator systems are operating normally, place the external power control switch in the GEN PARALLEL position. The following warning lights shall show the configurations indicated:
- (a) MAIN and AUX ON BUS lights - extinguished.
 - (b) Bus tie CONT OPEN lights - extinguished.
- (8) Actuate the No. 1 generator line switch to OPEN position.
- (a) The No. 1 generator line CONT OPEN lights shall illuminate.
 - (b) The No. 1 nonessential ac bus shall not be deenergized.
 - (c) Reading in No. 1 generator position on ac voltmeter shall be 115 (± 2.0) volts.
- (9) Actuate the No. 1 generator line switch to CLOSE position.
- (a) The No. 1 generator line CONT OPEN light shall extinguish.
 - (b) The No. 1 generator system shall reparallel with the other three generator systems.
- (10) Actuate the No. 1 generator bus tie control switch to OPEN.
- (a) The bus tie CONT OPEN light shall illuminate.
 - (b) The No. 1 generator position on the ac voltmeter shall indicate 115 (± 2.0) volts.

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- (c) The No. 1 generator system shall be operating isolated from the other three systems and powering the No. 1 nonessential ac bus.
- (11) Actuate the No. 1 bus tie control switch to the CLOSE position.
 - (a) The bus tie CONT OPEN light shall extinguish.
 - (b) The No. 1 generator system shall reparallel with the other three generator systems.
- (12) Repeat steps (8) through (11) for each generator system, the results shall be the same for each.
- (13) Actuate the external power control switch to EXT PWR.
 - (a) The AUX and MAIN ON BUS lights shall illuminate.
- (14) Place the pilots' ac essential bus selector switch in the EXT PWR position. Check that the ac voltmeter reads 115 (± 2.0) volts in the SYNC BUS position.
- (15) Shut down the engines one-by-one.
 - (a) As each engine reaches approximately 3700 (± 50) rpm, the generator line CONT OPEN lights shall illuminate.
 - (b) The bus tie CONT OPEN light shall extinguish.
- (16) When the last generator system is deenergized, check the following warning lights for the configuration indicated:
 - (a) Generator OFF lights - illuminated.
 - (b) Generator line CONT OPEN lights - illuminated.
 - (c) Generator bus tie CONT OPEN lights - extinguished.
 - (d) AUX and MAIN CONN and ON BUS lights - illuminated.
 - (e) Load reduction No. 1 and 4 lights - extinguished.
- (17) Actuate the battery control switch to NORMAL.
 - (a) The CHARGER RELAY OPEN light shall remain extinguished.
 - (b) The battery ammeter shall indicate from plus 1 to 10 amperes.
- (18) Actuate the battery control switch to OFF.
 - (a) The CHARGER RELAY OPEN light shall remain extinguished.
 - (b) The battery ammeter shall indicate zero.

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- (19) Actuate the No. 1 load reduction switch to the OFF position.
 - (a) The load reduction light for the No. 1 nonessential ac bus shall illuminate.
 - (b) There shall be no power on the No. 1 nonessential ac bus.
- (20) Actuate the No. 1 load reduction switch to the ON position.
 - (a) The load reduction light for the No. 1 nonessential ac bus shall extinguish.
 - (b) There shall be power on the No. 1 nonessential ac bus.
- (21) Repeat steps (19) and (20) substituting No. 4 for No. 1. The results shall be the same.
- (22) Actuate the External power control switch to OFF.
 - (a) All system indicator lights shall extinguish except the AUX and MAIN CONN lights.
 - (b) Only the EXT PWR position on the ac voltmeter shall show indication.
- (23) Turn off external ac power unit.
 - (a) The AUX and MAIN CONN lights shall extinguish.
 - (b) The main and auxiliary on lights at the external power receptacle opening shall extinguish.
- (24) Open all circuit breakers and remove external power unit plugs from receptacle.

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GENERATORS - MAINTENANCE PRACTICES1. Removal/Installation Generators (see Figure 201)

A. Equipment Required.

- (1) Stand or cart capable of handling approximately 77 pounds.

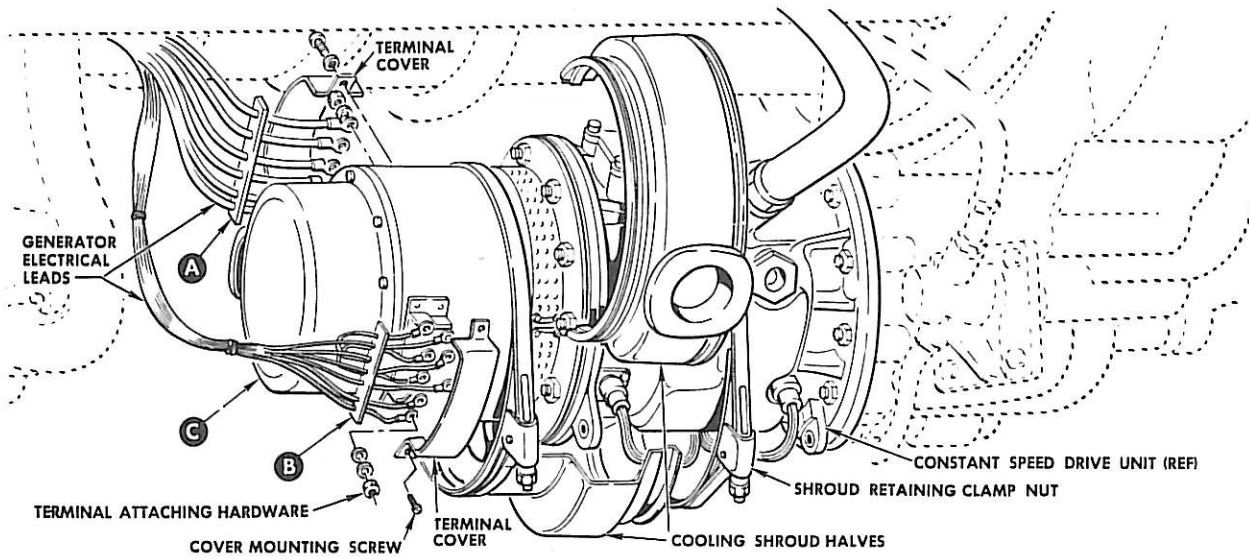
B. Remove Generator.

NOTE: The following procedure is common for all generators:

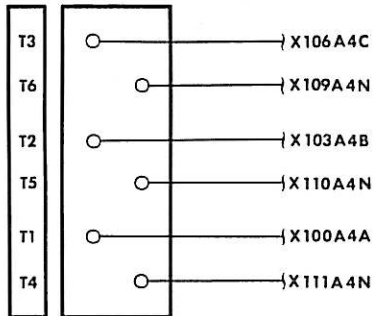
- (1) Place applicable generator system manual controls in off position.
- (2) Remove safety wire from terminal block cover retaining screws; remove screws and covers.
- (3) Remove all electrical connections.
- (4) Loosen retainer clamp nuts that secure the cooling shroud halves; remove clamps and shroud halves.
- (5) Remove 12 nuts fastening generator to constant speed drive unit.

C. Install Generator.

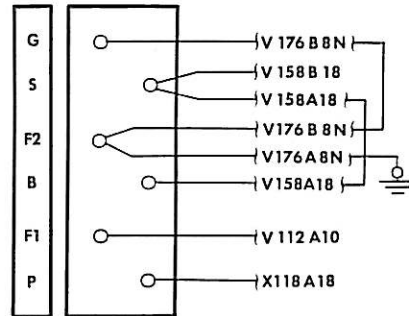
- (1) Lift generator into position and align mounting holes with stud bolts on drive output end.
- (2) Replace 12 nuts taken off in removal step (4).
- (3) Install cooling shroud halves and retainer clamps; tighten clamp nuts.
- (4) Connect all electrical wiring.
- (5) Replace terminal block covers and secure with screws taken off in removal step (2).
- (6) Install safety wire.
- (7) Turn on applicable generator system controls.
- (8) Check system operation (refer to Section 24-2-0, Maintenance Practices).



A

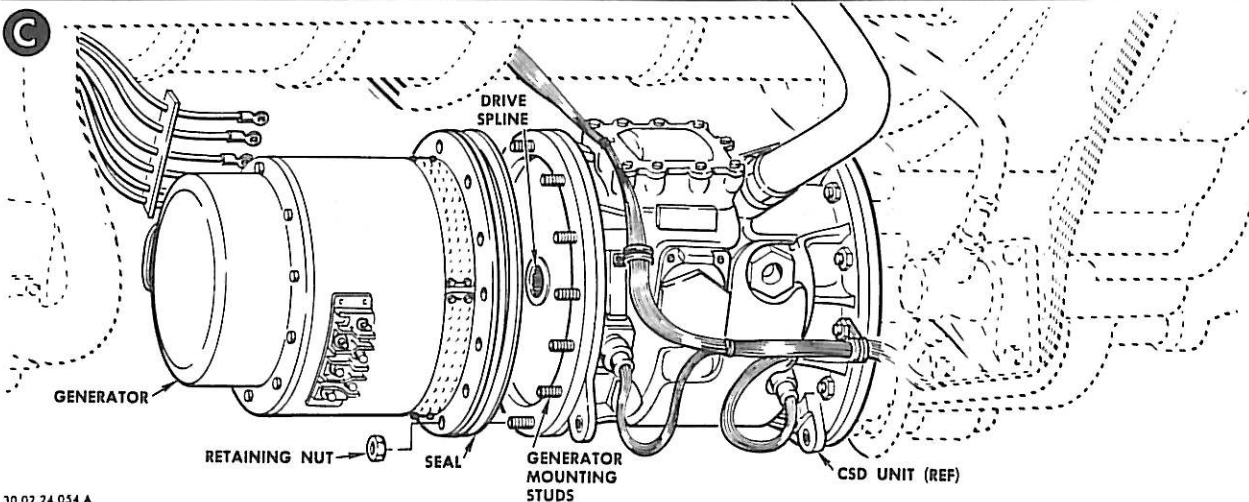


B



GENERATOR TERMINAL STRIPS

C



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2. Inspection/Check Generators

A. General. Visually check the generator at periodic engine check.

B. External Inspection.

- (1) Generator mounting. Nuts must be secure and mounting studs free from damage.
- (2) Terminal blocks and connections. Remove covers; terminal blocks must be free from damage and connections must be clean and tight.
- (3) Safety-wiring and locking tags. Check that all wiring and locking is correct and secure.

C. Internal Inspection.

- (1) Remove air inlet to check collector rings, brushes, brush springs and connections as follows:
 - (a) Collector rings. Visually check that they are free from oil and grease and that their surfaces are not burned, pitted or damaged.
 - (b) Brushes. Visually check brushes by removing them from the brush holders and check for wear and damage. A brush is fully worn when the length, measured on the long side, is 1 3/16-inches. Replace brushes before they are worn to this extent to prevent possible damage to the collector rings or brush holders by arcing. Brushes worn to the wear-groove mark indicate that approximately 1/8-inch of available wear remains. Brushes must not bind in the brush holders.
 - (c) Brush springs. Visually check for evidence of distortion or discoloration due to overheating.
 - (d) Connections. Visually and manually check security of brush rigging connections. They must be clean, tight, and properly safety-wired.

NOTE: Reworking of burned or damaged collector rings and replacement of brushes will require removal of the generator from the airplane (refer to Removal/Installation). Should abnormal brush wear occur, carefully check collector rings for damaged surfaces.

3. Adjustment/Test Generators

A. General.

When a generator malfunction is indicated, check as described in the Inspection/Check procedure. If no mechanical fault is observed, remove all electrical connections to the generator and test winding

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resistances. Resistances must be within the following values (when corrected to 25) degrees C (77 degrees F).

B. Equipment Required. Accurate Ohmmeter.

C. Test Stator Windings.

(1) Measure resistance from T1 to T4, T2 to T5, and T3 to T6.

(2) Readings shall be 0.0244 to 0.0256 ohm.

NOTE: All phases must balance within 1 1/2 percent.

D. Test Rotor Windings.

(1) Measure resistance between collector rings with brushes lifted.

(2) Readings shall be 0.615 to 0.645 ohm.

E. Test PMG Stator Windings.

(1) Measure resistance from terminal P to terminal G.

(2) Reading shall be 0.305 to 0.335 ohm.

F. Test Generator Windings for Shorts.

Check as follows with a continuity tester; there shall be no continuity:

(1) From F1 to F2 (with the brushes up) and from F1 and F2 to the end shield.

(2) From either collector ring to the outboard end of the rotor shaft.

(3) From T1, T2, and T3 to the frame and from T1 to T2, T1 to T3, and T2 to T3.

(4) Disconnect the PMG lead that is connected to the capacitor and check from the end of the disconnected lead to the end shield.

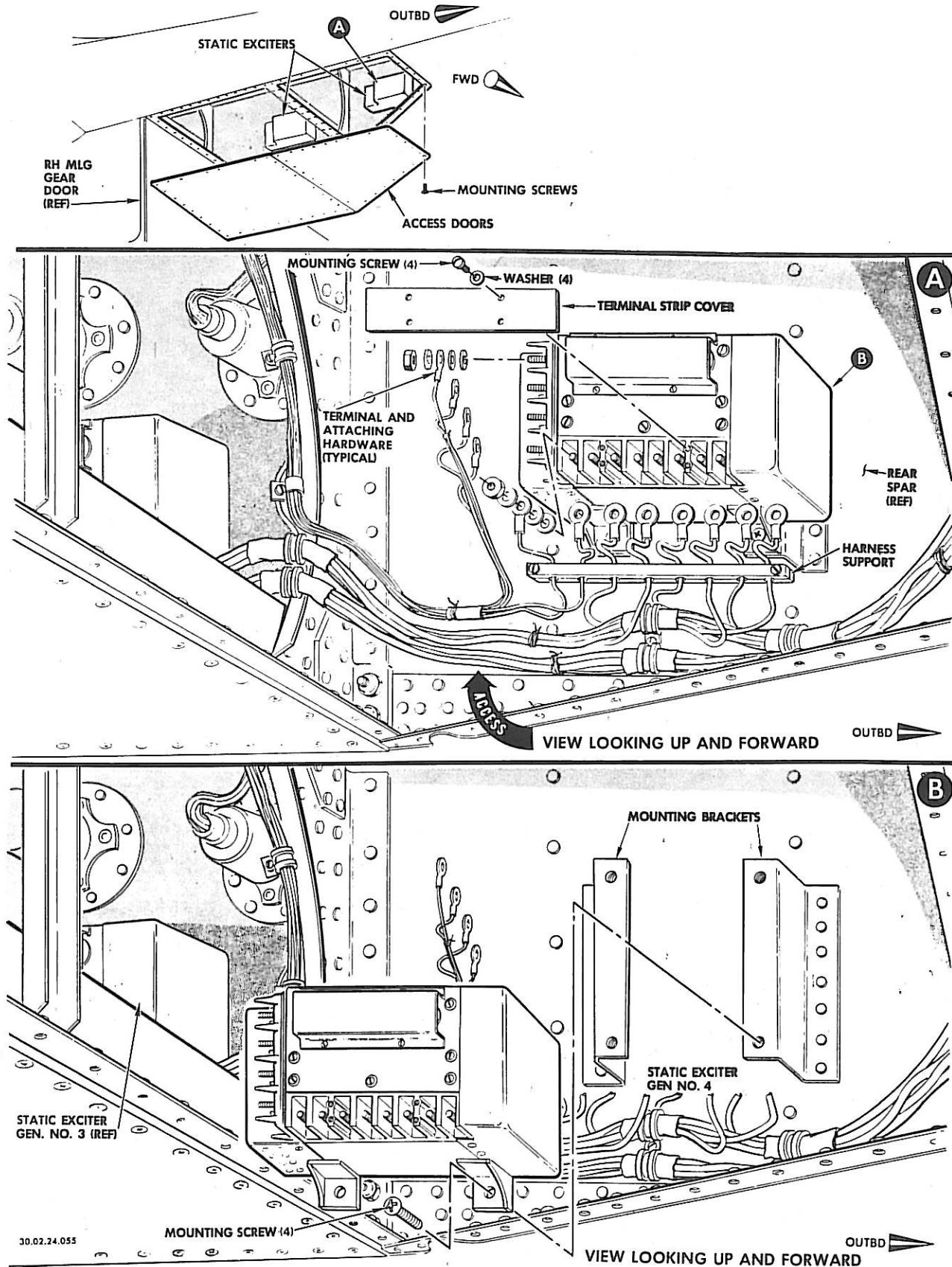
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STATIC EXCITER - MAINTENANCE PRACTICES

1. Removal/Installation Static Exciter (see Figure 201)
 - A. Equipment Required - None.
 - B. Remove Static Exciter.
 - (1) Check that the applicable generator system's control switches are off.
 - (2) Remove cover from static exciter terminals.
 - (3) Remove screws securing wire terminals.
 - (4) Remove four mounting screws securing static exciter to mounting bracket nutplates.
 - C. Install Static Exciter.
 - (1) Place static exciter in position with mounting holes aligned to nut-plates and install screws.
 - (2) Connect static exciter wires.
 - (3) Replace terminals block cover.
 - (4) Turn on applicable generator system manual controls.
 - (5) Test system operation (refer to Section 24-2-0, Adjustment/Test).

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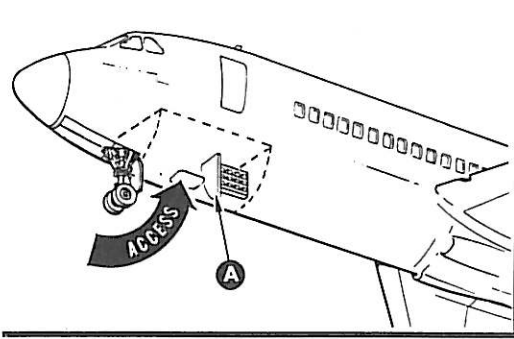
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CONTROLLER-REGULATOR - MAINTENANCE PRACTICES

1. Removal/Installation Controller-Regulator (see Figure 201)
 - A. Equipment Required - None.
 - B. Remove Controller-Regulator.
 - (1) Turn applicable generator system controls off.
 - (2) Cut safety wire from two swivel-type knurled retaining nuts.
 - (3) Loosen swivel-type knurled retaining nuts and unhook from clips on front of unit.
 - (4) Remove electrical connector.
 - (5) Remove screw and washers securing bonding jumper to controller-regulator.
 - (6) Using handle on front of controller-regulator, slide out unit and lift from shelf.
 - C. Install Controller-Regulator.
 - (1) Lift controller-regulator in position on third shelf of electrical rack and slide into position.
 - (2) Lift swivel-type knurled retaining nuts over clips on front of unit and tighten.
 - (3) Install electrical connector.
 - (4) Safety-wire connector.
 - (5) Attach bonding jumper to controller-regulator using screw and washers.
 - (6) Turn on applicable generator system manual controls.
 - (7) Test system operation (refer to Section 24-2-0, Adjustment/Test).

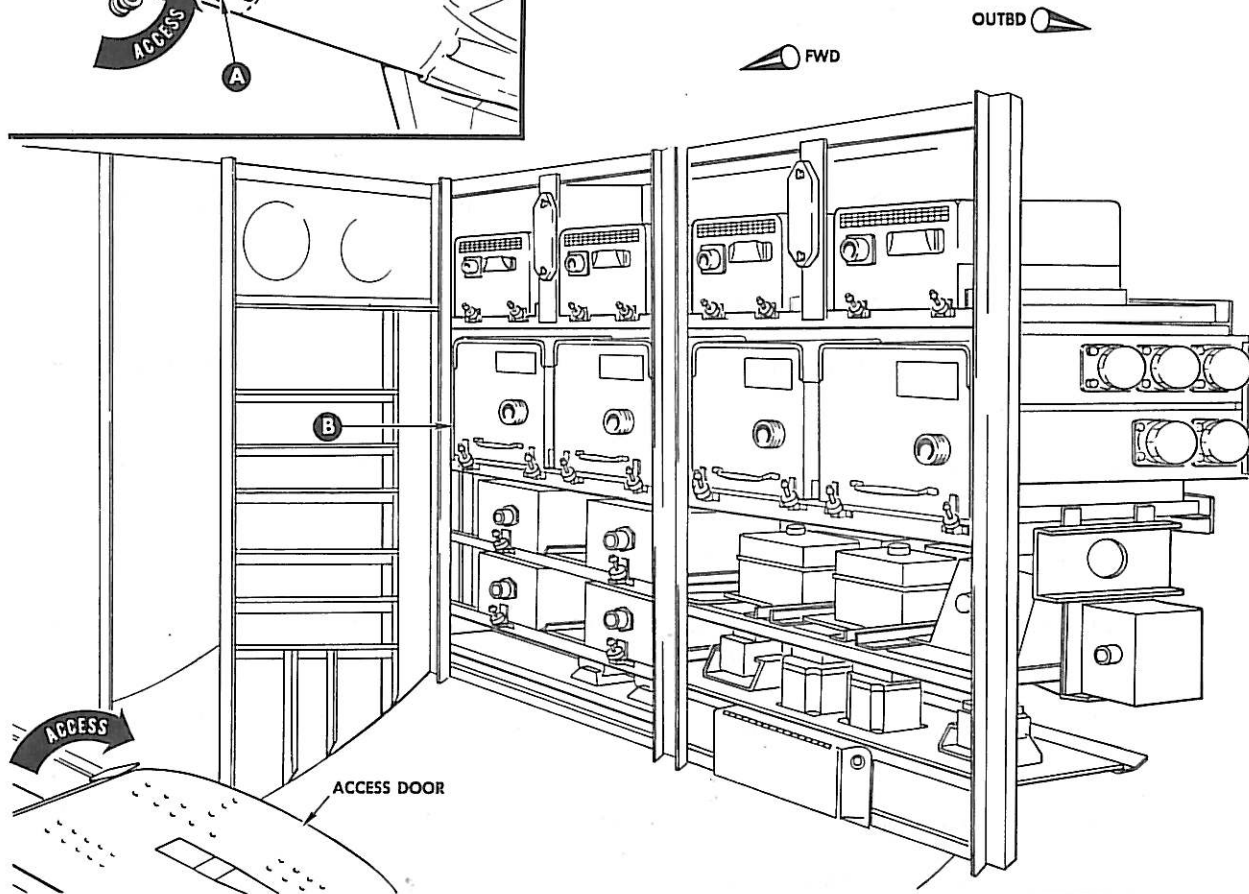
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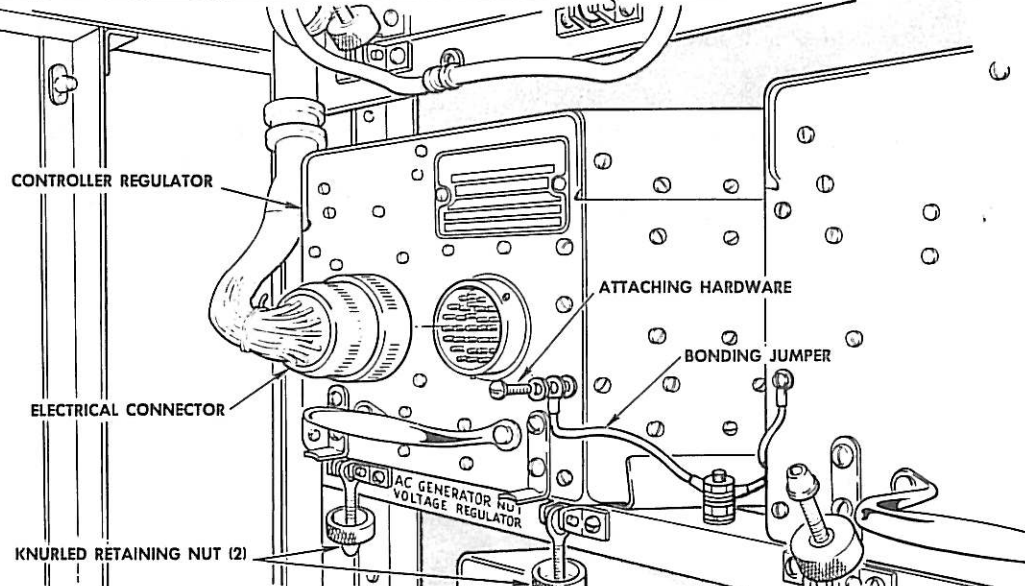


A

ELECTRICAL EQUIPMENT RACKS -VIEW LOOKING FORWARD



B



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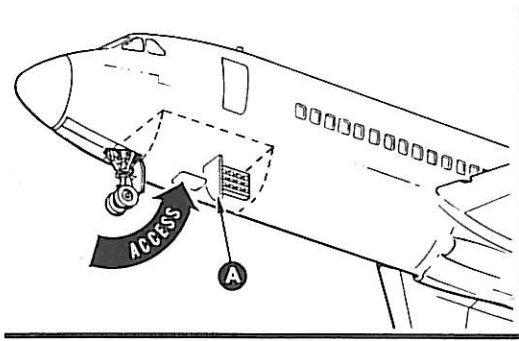
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SYNC BUS PROTECTION PANEL - MAINTENANCE PRACTICES

1. Removal/Installation Sync Bus Protection Panel (see Figure 201)
 - A. Equipment Required - None.
 - B. Remove Sync Bus Protection Panel.
 - (1) Remove airplane power.
 - (2) Remove electrical connector from sync bus protection panel receptacle located on aft face of electrical rack.
 - (3) Remove four screws securing unit to mounting brackets.
 - C. Install Sync Bus Protection Panel.
 - (1) Position replacement unit in alignment with holes in mounting bracket.
 - (2) Install four screws from removal step (3).
 - (3) Install and tighten electrical connector.
 - (4) Turn on airplane power.
 - (5) Test system operation (refer to Section 24-2-0, Adjustment/Test).

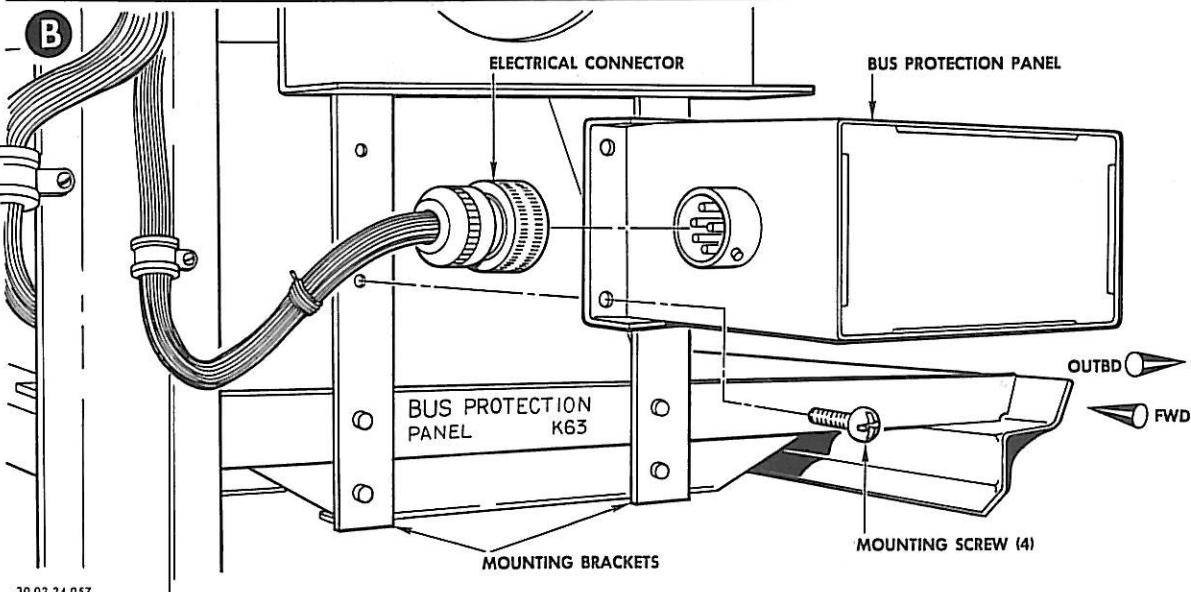
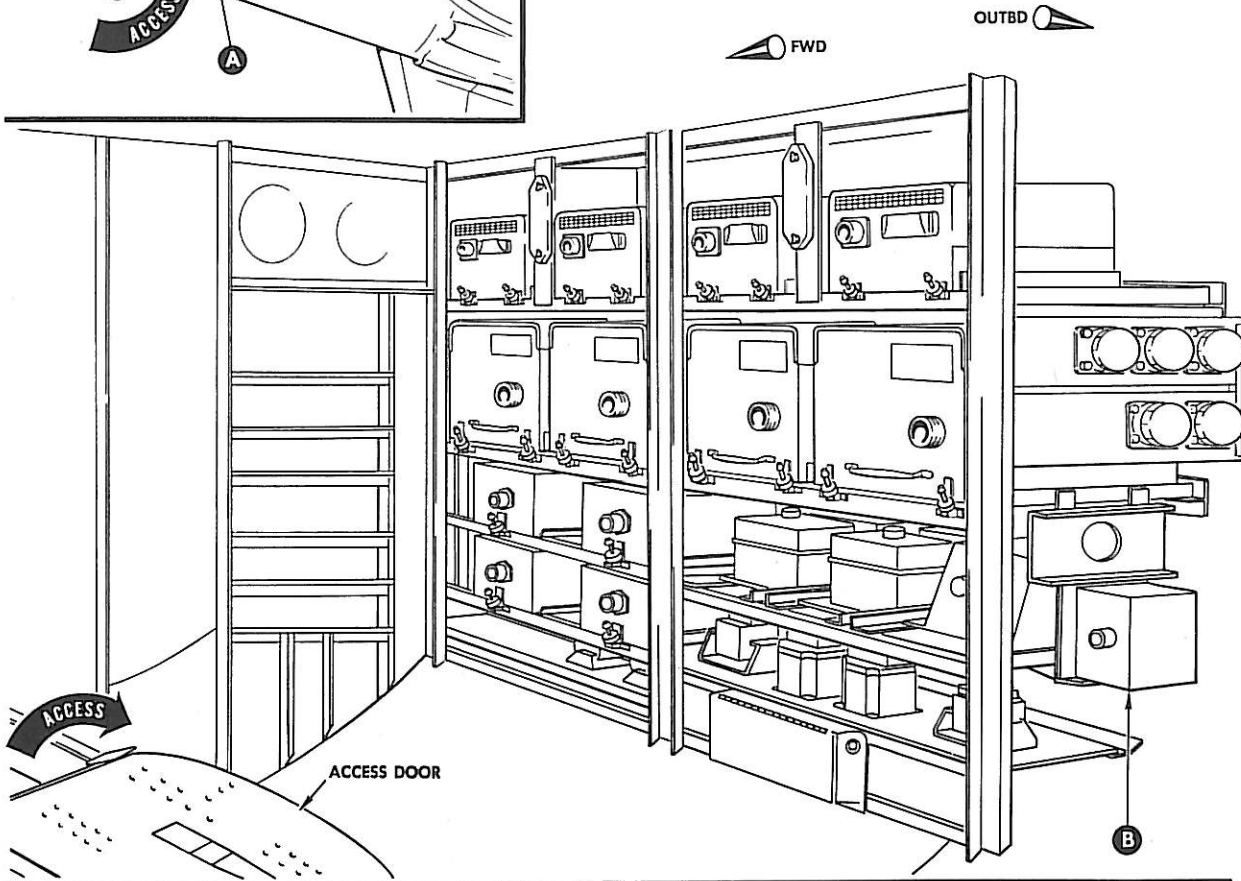
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A

ELECTRICAL EQUIPMENT RACKS - VIEW LOOKING FORWARD

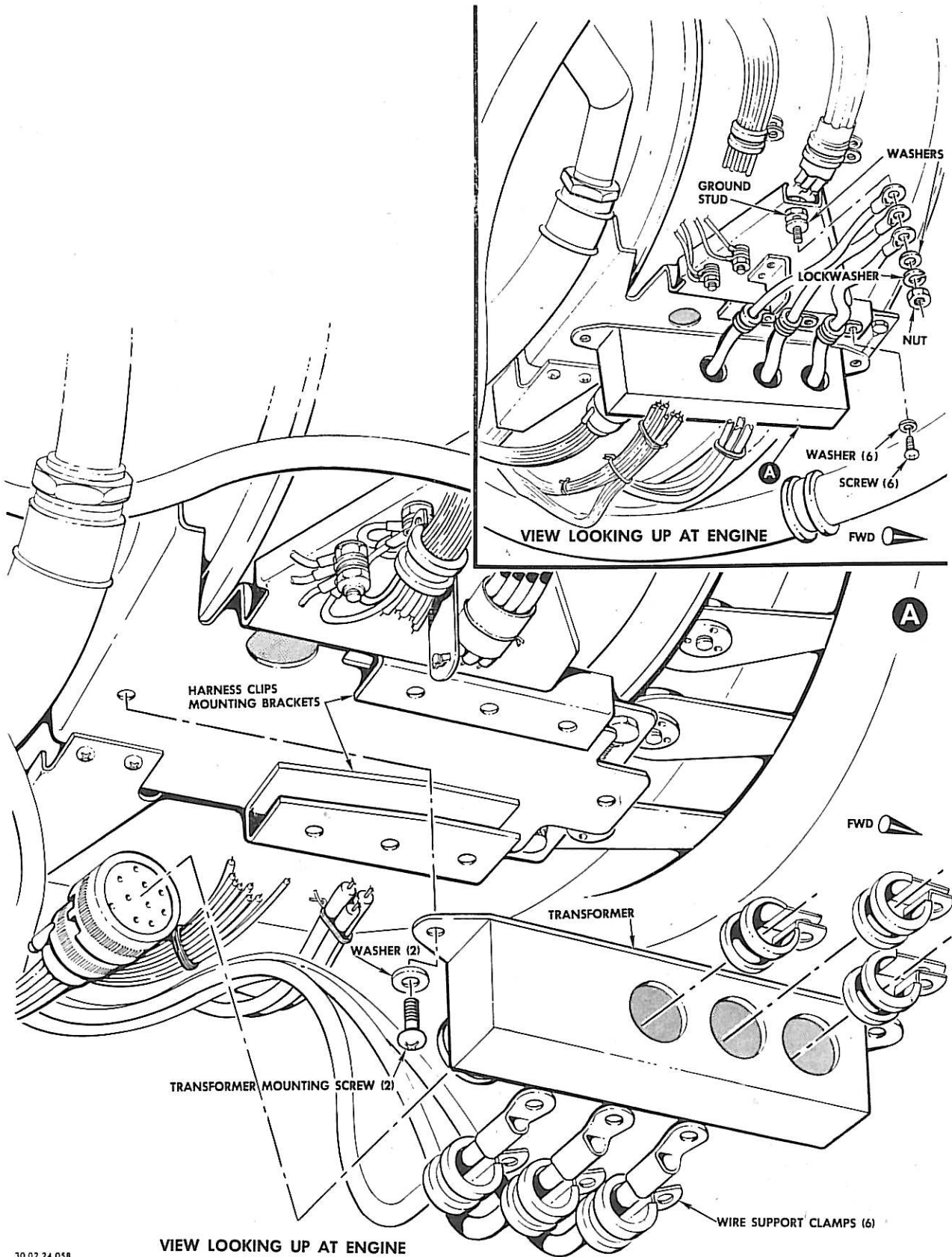


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DIFFERENTIAL PROTECTION CIRCUIT - MAINTENANCE PRACTICES

1. Removal/Installation Differential Protection Current Transformer (see Figure 201)
 - A. Equipment Required - None.
 - B. Remove Current Transformer.
 - (1) Deenergize applicable ac generator system.
 - (2) Remove nut holding ground wires on ground stud.
 - (3) Slip terminals from ground stud.
 - (4) Remove 6 wire-support clamps (each wire supported by one clamp on each side of transformer) by removing bolt securing clamp to mounting channel.
 - (5) Remove electrical connector from side of transformer.
 - (6) Remove 2 transformer mounting bolts.
 - (7) Remove transformer by slipping it over 3 wires inserted in transformer openings.
 - C. Install Current Transformer.
 - (1) Place generator wires in proper transformer openings.
 - (2) Position transformer to allow 2 mounting bolts to be installed.
 - (3) Install 6 wire-support clamps and bolt in position.
 - (4) Place wire terminals over ground stud and secure with hardware taken off in removal step (2).
 - (5) Replace electrical connector and safety-wire.
 - (6) Energize applicable ac generator system.
 - (7) Test system operation, (refer to Section 24-2-0, Adjustment/Test).



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MANUAL CONTROL SWITCHES - MAINTENANCE PRACTICES1. Removal/Installation Manual Control Switches (see Figure 201)

A. General.

The referenced figure illustrates the four types of switches used in the ac electrical power supply system. The installation technique of each varies slightly. However, the procedure given here can be adapted to a particular switch.

B. Equipment Required - None.

C. Remove Switch.

- (1) Remove airplane power.
- (2) Open Camloc fasteners securing ac generator control panel and swing panel open.
- (3) If necessary loosen set-screw securing knob to switch; retain knob for installation.
- (4) If necessary remove edge lighting panel (refer to Chapter 33, LIGHTS).
- (5) Remove switch retaining nut, inside star-washer, and locking ring.
- (6) Remove wires from back of switch and remove switch.

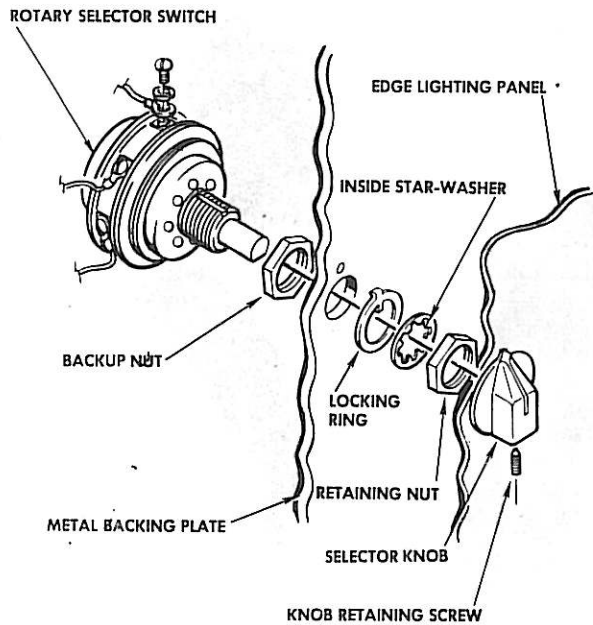
D. Install Switch.

- (1) Attach wires to switch.
- (2) Place switch in mounting hole and secure by placing locking ring and inside star-washer over threaded collar and installing the retaining nut.

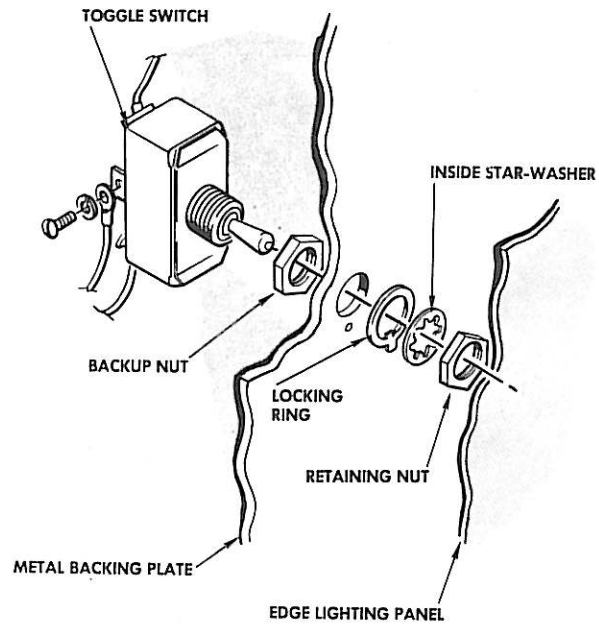
NOTE: Be sure lip on locking ring is in the pilot hole of the panel.

- (3) Replace edge lighting panel.
- (4) If required, tighten set-screw to secure knob to switch.
- (5) Close ac generator control panel and fasten Camlocs.
- (6) Turn on airplane power.
- (7) Check system operation (refer to Section 24-2-0, Adjustment/Test).

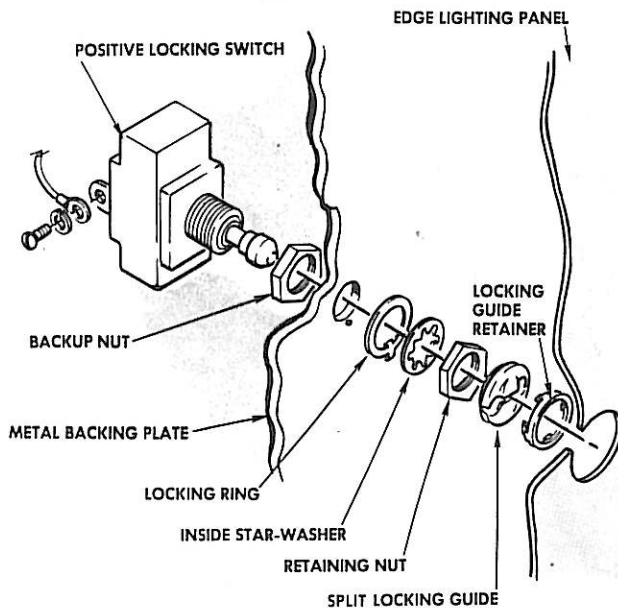
MAINTENANCE MANUAL



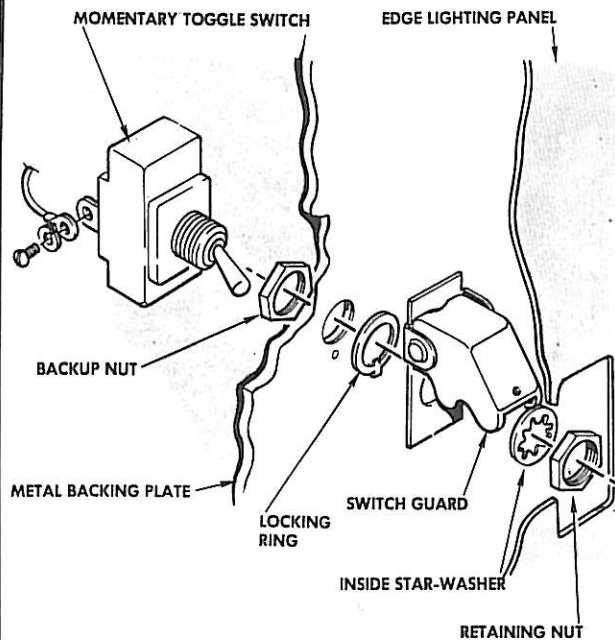
TYPICAL FOR:
AC FREQUENCY/VOLTMETER SELECTOR SWITCH
DC VOLTMETER SELECTOR SWITCH
PILOTS' AC ESSENTIAL BUS SELECTOR SWITCH



TYPICAL FOR:
KW/KVAR SELECTOR SWITCH
EXTERNAL POWER CONTROL SWITCH
LOAD REDUCTION CONTROL SWITCHES



TYPICAL FOR:
GENERATOR LINE CONTACTOR CONTROL SWITCHES
BUS TIE CONTACTOR CONTROL SWITCHES
GENERATOR CONTROL SWITCHES
26-VOLT AC SELECTOR SWITCH
T-R CONTROL SWITCHES
BATTERY CONTROL SWITCH



TYPICAL FOR:
GENERATOR DISCONNECT SWITCHES

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MAINTENANCE MANUAL

AC SYSTEM POWER CONTACTORS - MAINTENANCE PRACTICES

1. Removal/Installation AC System Power Contactors (see Figure 201)

A. Equipment Required - None.

B. Remove AC System Power Contactors.

- (1) Check that all airplane power is removed.
- (2) Remove screws securing plastic guard covering terminal studs.
- (3) Remove all wires and bus bars from terminal studs.
- (4) Remove electrical connector.
- (5) Remove contactor mounting screws.

NOTE: Identify screw under which bonding jumper is installed.

C. Install AC System Power Contactor.

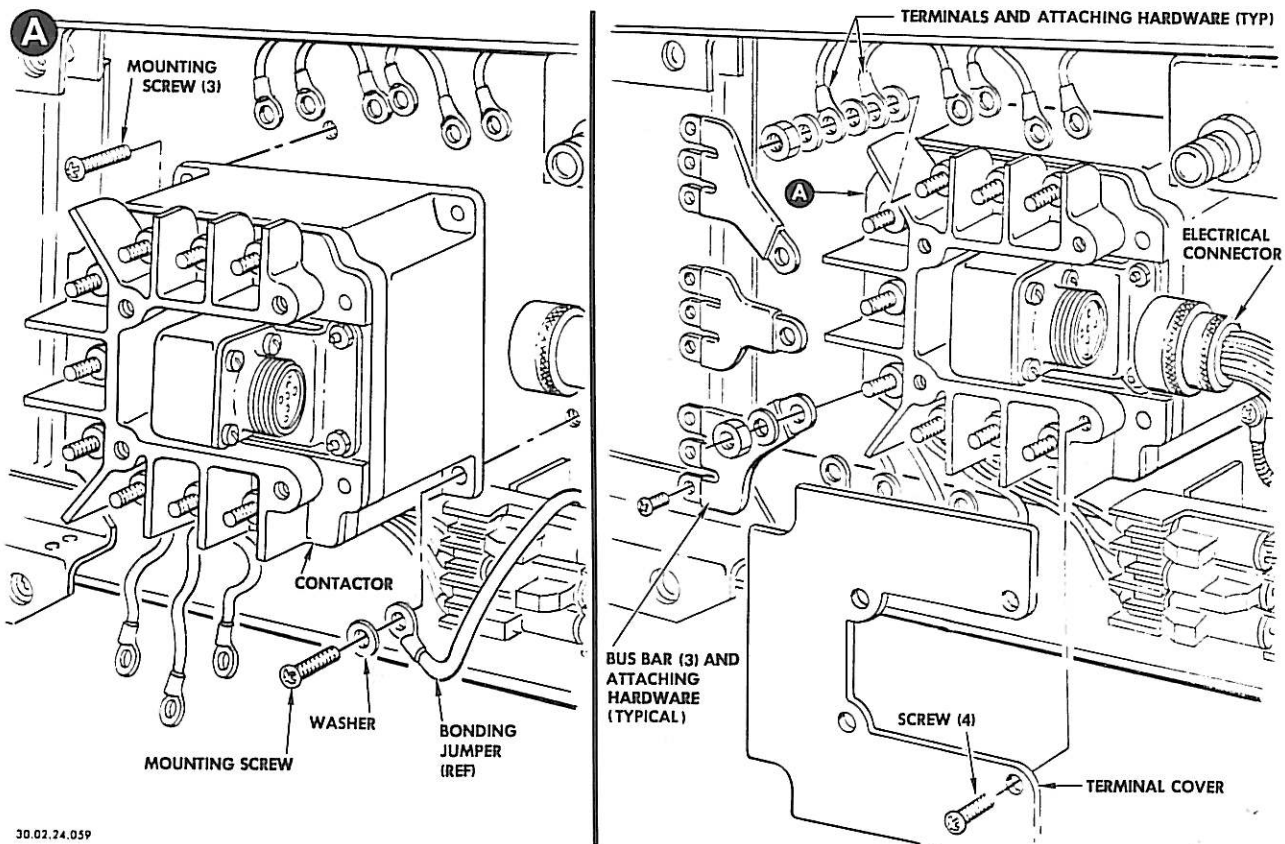
- (1) Place contactor in proper position and install mounting screws.

NOTE: Replace bonding jumper under same mounting screw head as original.

- (2) Attach all wires and bus bars.
- (3) Place plastic guard in position over terminals and secure with mounting screws.
- (4) Test unit operation (refer to Section 24-2-0, Adjustment/Test).

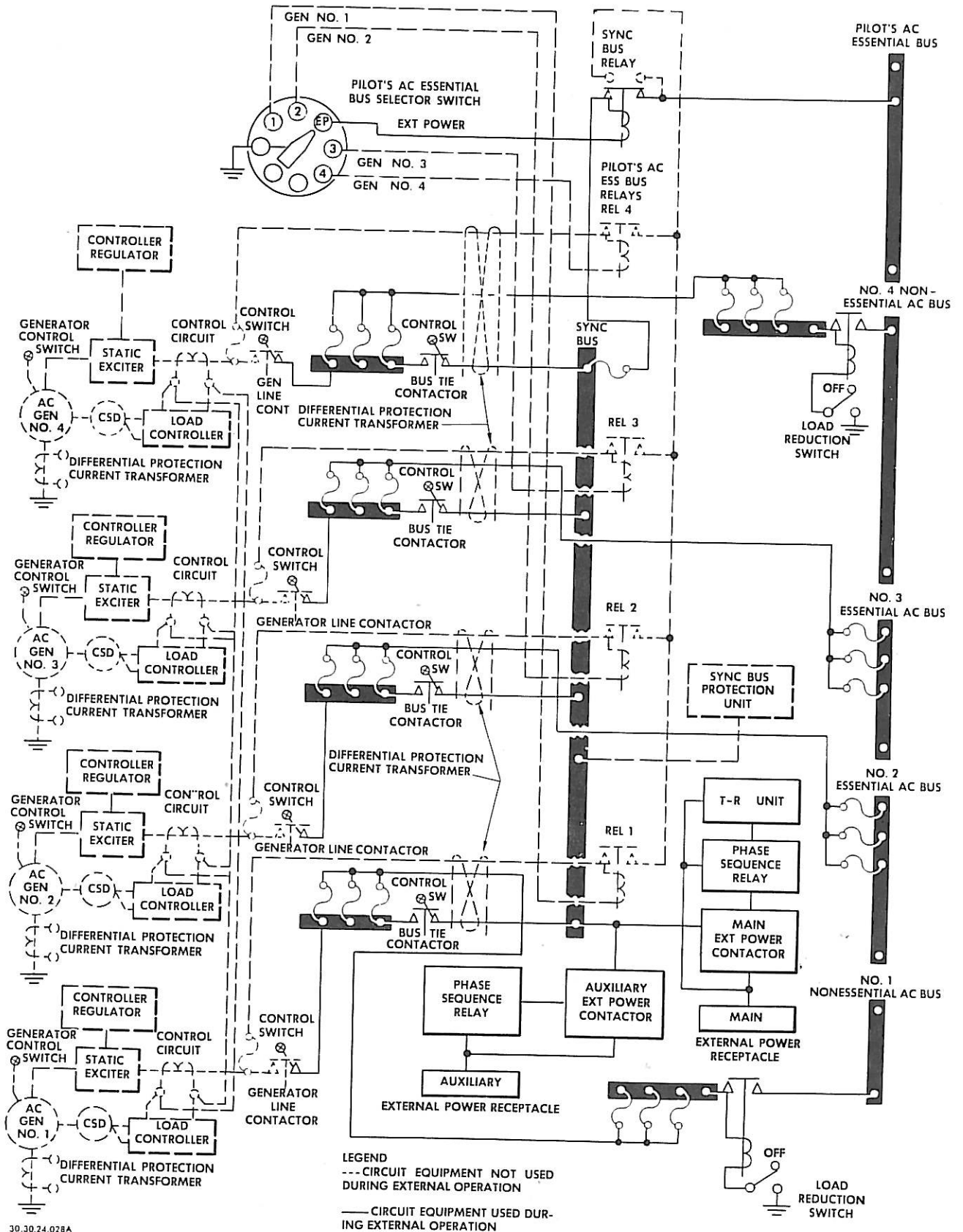
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Generator Line and Bus Tie Contactor
Installation
Figure 201



MAINTENANCE MANUAL

EXTERNAL AC POWER SYSTEM - DESCRIPTION AND OPERATION1. Description

The external ac power system (see Figure 1) consists of two external power receptacles, two power contactors, two phase sequence relays, a transformer-rectifier unit, a control switch, warning and indication lights and the necessary circuitry for interconnection. * A nose tow power system supplies ac and dc power to certain circuits during towing. The MAIN and AUXILIARY receptacles are located on the forward right side of the fuselage, below and forward of the forward service door at fuselage station 365. The external power control switch is located on the flight engineer's ac control panel and the majority of the other components are located inside the electrical compartment, in or near the external power junction box. Figure 2 is a block diagram showing the interconnections with the normal ac power system.

NOTE: The external ac power unit should be a 4-wire, wye-connected unit capable of delivering 115/200-volt, 3-phase, 400-cps ac continuously. The unit rating should be 125-KVA at a 0.9 power factor.

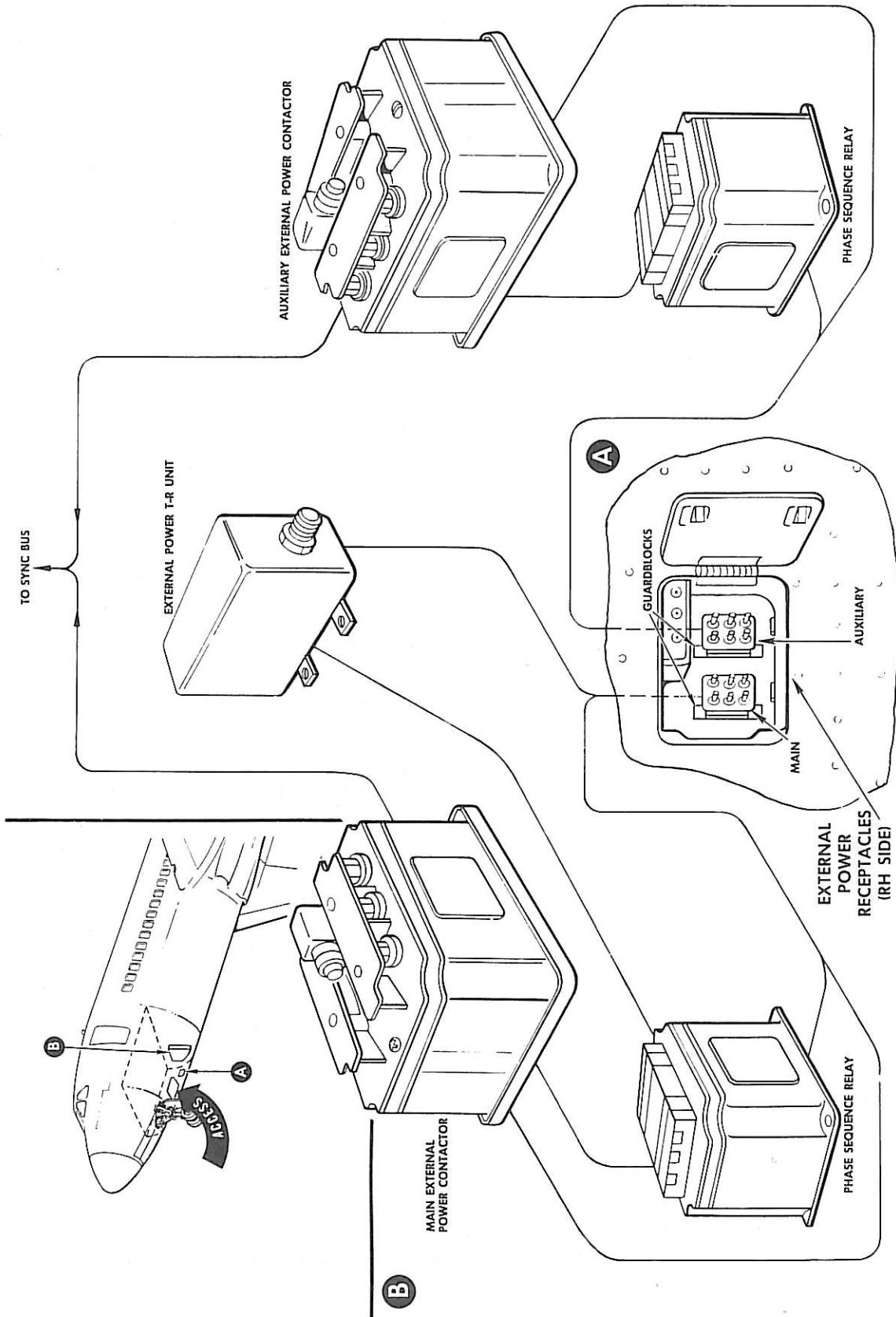
2. Operation and Distribution

The ac or dc system control switches are not opened during aircraft shutdown; therefore, the generator control switches remain ON and the generator line and bus tie contactor control switches remain in the CLOSE position. The external power control switch should be placed in the OFF position before the external power plug is connected. When the MAIN plug is connected and energized by the external ac power unit, the external power transformer-rectifier is energized. *Power energizing the transformer-rectifier unit is routed through the normally closed contacts of the nose tow power transfer relay (see Figure 3). The circuitry in the main phase sequence relay senses whether or not phase rotation is correct. If the phase rotation is correct a set of contacts in the phase sequence relay close and route dc power to the coil of the main external power contactor. (The ground circuit for this contactor is not yet complete so it does not energize at this time.) The main-connected (MAIN CONN) indicator light on the ac control panel and the main power ON light at the external power receptacle illuminate. Ac power from the ϕ C line of the main external power receptacle is routed through a set of normally-closed contacts in the main external power contactor to the coils of the four ground maintenance relays. Now ac and dc power is routed to the various airplane circuits needed for ground maintenance.

When the external power control switch is placed in the ON position; the MAIN CONN light remains illuminated and the MAIN ON BUS light on the ac control panel also illuminates. The main external power contactor is energized removing power from the coils of the ground maintenance relays deenergizing them. The main contactor now supplies power to the sync bus; the bus tie contactors close, supplying power to all essential buses. (The pilot's ac essential bus selector switch must be placed at EXT PWR.) The No. 1 and

*Applicable to airplanes equipped with a nose tow power receptacle.

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